Pit and Quarry

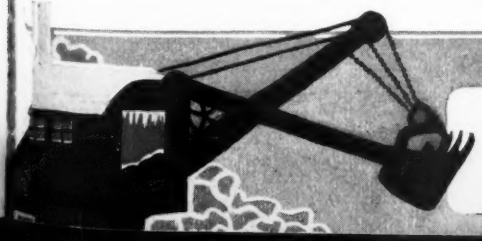
SAND - GRAVEL - STONE
CEMENT - LIME - GYPSUM

ANNOUNCING

a series of articles by C. H. Sonntag on Prime Movers in Crushed Stone and Sand and Gravel Plants, written expressly for PIT and QUARRY. The first article will be published in the November 1st number.

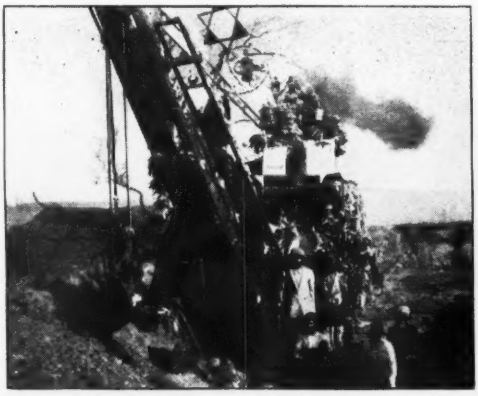
Also authoritative articles in that number on important subjects by George B. Massey, F. A. Westbrook, George Ransom, E. D. Roberts, R. N. Van Winkle and others.

THE PUBLISHERS



October 15, 1925

Circulation 7,600

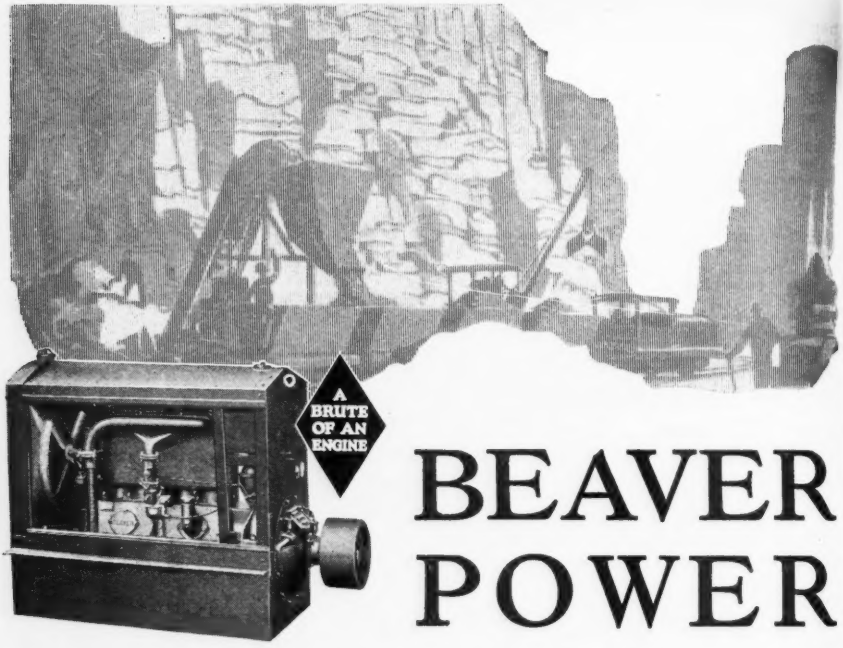


Type "B" ERIE owned by the Central Provinces Portland Cement Co., Ltd., Kymore, India, fittingly decorated to appease the gods during a holiday celebration.

This ERIE operates with an extremely complete crew of 7 men — the total wages of the whole lot amounting to $1.41 per day. The operator gets 33 cents for nine hours, the fireman 24 cents, and the pitmen, helpers, etc., draw 14 to 24 cents per day.

Besides excavating for foundations, stripping, digging rock, etc., this ERIE was used as a hoist when their gasoline hoisting apparatus broke down; has dug a mile of drainage ditch; moved coal to put out a fire; graded an artificial lake.

Photo kindly sent by Mr. G. L. Austin.



BEAVER POWER

for Sand Pit and Quarry

Beaver Power Units are used in sand pits and quarries where portable, dependable power units are needed. They have won acceptances over a period of 23 years because they have given consistent, economical power.

Enclosed in an all steel housing, the Beaver is well protected against falling materials. All working parts are readily accessible when sides are removed.

A pulley is furnished so that it can be belted to any machine.

It contains a valve-in-the-head engine, force-feed lubrication, a foolproof and trustworthy system. All working parts are made big to give greater strength and longer life.

BEAVER MANUFACTURING CO.
35 25th St., Milwaukee, Wis.

FOR STEADY SERVICE
Beaver

KOEHRING

Crane

SPEED and precision of operation are the true terms of crane capacity! Both are achieved to greater degree than ever before by Koehring double-equalized, outside-band friction clutches. The greater holding surfaces give easy finger-tip control at the operating levers —give it with simplified, rather than more complicated mechanism! Greater speed, surer operating precision, extra capacity that's the Koehring result!

Crane Capacities

No. 1—¾ cu. yd. clamshell bucket on 40 ft. boom, standard. Lifting capacity, 10 tons at 12 ft. radius. 4 cylinder, 5" x 6" gasoline engine, 1000 R.P.M.

No. 2—1 cu. yd. clamshell bucket on 45 ft. boom, standard. Lifting capacity, 15 tons at 12 ft. radius. 4 cylinder, 5¾" x 7" gasoline engine, 1000 R.P.M.

Write for Crane Bulletin No. Cr. 32.

KOEHRING COMPANY

Pavers, Mixers—Gasoline Cranes, Draglines and Shovels

MILWAUKEE, WISCONSIN

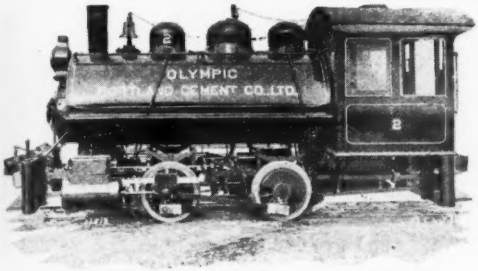
Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1870, 50 Church St., New York City

Canada, Koehring Company of Canada, Ltd., 105 Front St., E., Toronto, Ont.

Mexico, F. S. Lapum, Cinco de Mayo, 21 Mexico, D. F.

A2623
III-IV



and Locomotive Olympic Plant!

Vulcan Steam Locomotives have a similar story of long-enduring service to tell. The first of these—a 40-ton Engine, 14 by 20-inch cylinders—was as good for work as when new, after 11 years' hauling. So, in 1923, when the second "loco" was needed, of course a Vulcan was selected. The second is a 21-ton, with 11x16-inch cylinders.

There's no questioning the fact that Vulcan Kilns and Locomotives stand the gaff. Ask any user listed in the panels on this page. And ask, too, about Vulcan efficiency of operation and performance. Shall we send copies of the Vulcan Bulletins?

VULCAN IRON WORKS
1737 Main Street, Wilkes-Barre, Pa.

Established 1849

New York Office:
50 Church St.

Chicago Office:
McCormick Bldg.

VULCAN of WILKES-BARRE LOCOMOTIVES

Ask any of these users—*they know!*

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Asano Cement Co. ...(1)
Atlas P. C. Co.....(1)
Acme Cement Co.....(1)
Bonner Brand P. C. Co. .....(1)
Castalia P. C. Co.....(2)
Canadian P. C. Co...(2)
Cuban P. C. Co.....(3)
Coplay Cement Co....(2)
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Fort Dodge P. C. Co..(2)
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IN ACTION

The Modern Massillon Steam Shovel in action proves its great ability for work. It will increase your daily turnover to a greater percentage through its accessibility and adaptability to meet conditions.

The Massillon has been designed and constructed to be on the job when difficulty is present, also when obstacles unforeseen have to be overcome. It can be used with clamshell or dragline equipment or as a locomotive crane. Write for further particulars.

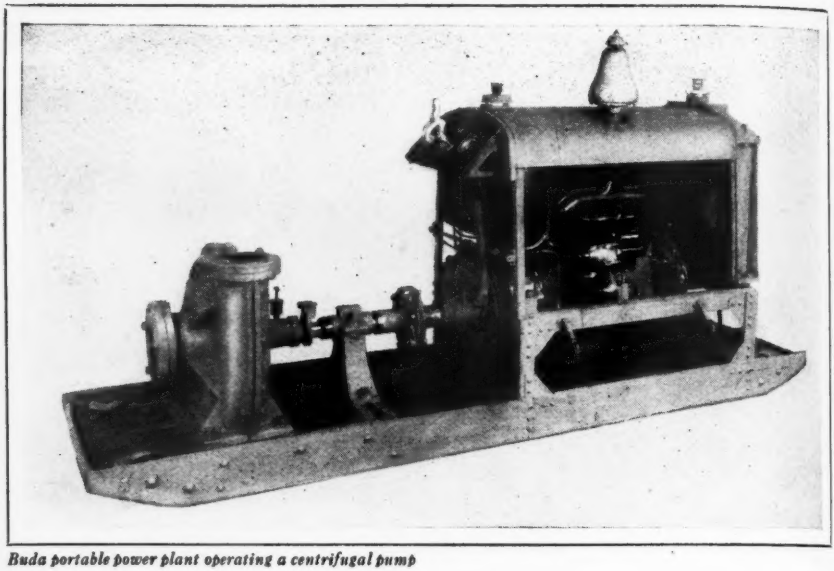
THE RUSSELL & CO.

MASSILLON, O.

(Established 1842)

The MODERN MASSILLON

Steam 3/4—7/8 RANGE Shovel



Buda portable power plant operating a centrifugal pump

It works anywhere

A compact, portable pumping outfit like the one pictured above is a necessity to almost every road builder and general contractor.

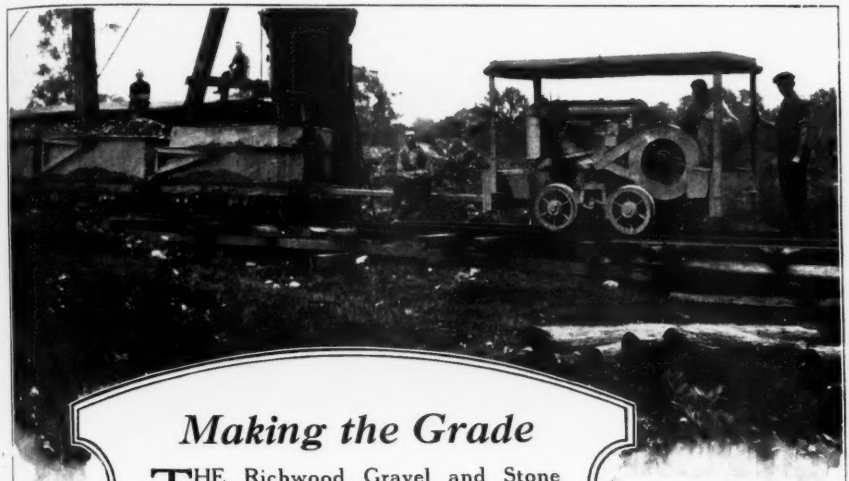
Fitted with a centrifugal pump and powered with a Buda engine, it is easily started and runs smoothly all day long under full load. Requiring no special foundation, it can be quickly moved from place to place. Standard Buda power plants also are being used for air compressors, loaders, ditchers and similar contractors' equipment where the requirement is for low-cost reliable power. Sizes range from 20 to 87 horse power. Write today for bulletins describing these sturdy, steady-working power plants.

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.

ESTABLISHED 1881

Buy only genuine Buda Parts for your Buda engine

BUDA
The
ENGINE



Making the Grade

THE Richwood Gravel and Stone Company, Richwood, Ohio, believe in Brookville Locomotives. They have bought four Brookvilles and find them to be even more serviceable than expected.

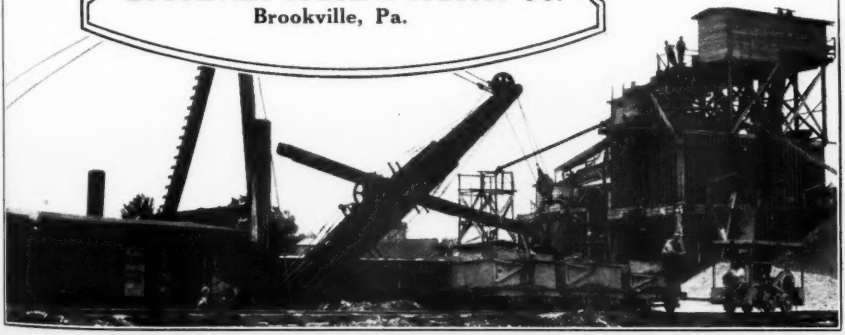
Mr. Kagay of the Richwood Gravel and Stone Company writes:

"The Brookville Locomotive is a very satisfactory outfit . . . it can take a grade in high that we thought it would do well to take in second."

Brookville performance is like that—a revelation of power and dependability. Users of Brookville Locomotives are continually indicating their approval in no uncertain terms. A single commendation would be no definite proof of excellence but such widespread satisfaction means that Brookville Locomotives are "making the grade" consistently.

The co-operation of our Engineering Department is available without obligation to you. Write for further information.

Brookville Truck & Tractor Co.
Brookville, Pa.

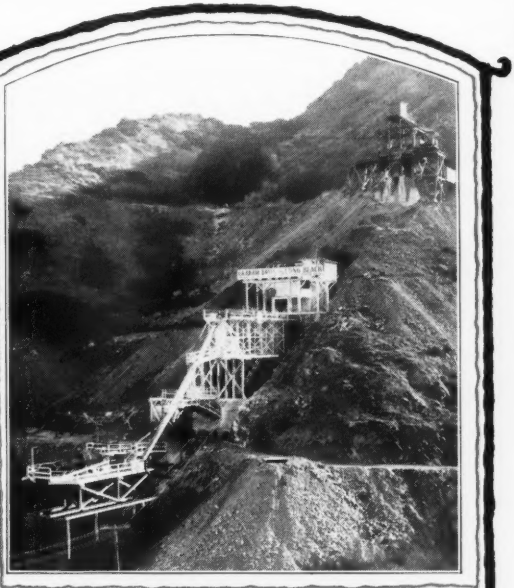


BR , INC. CHOOSE MER BOTH PLANTS

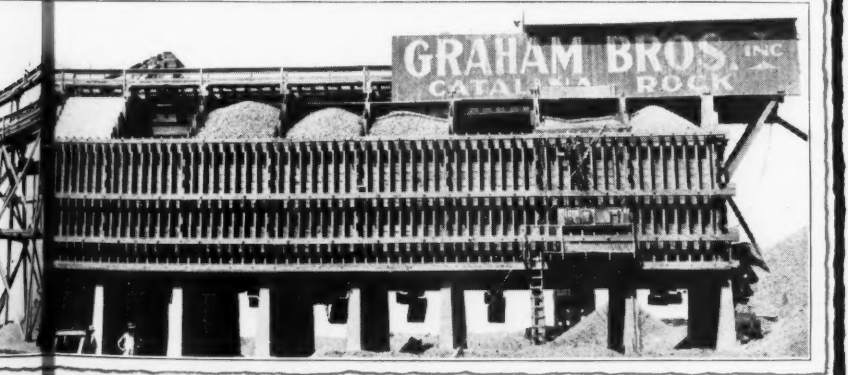
see next—page 63)

buting Graham Brothers, Incor- Beac nia, is equipped with S-A e inge gement makes provision age of ades of material. Trucks instan avity from the bunkers. is distr 30,000 tons of material ly at t m Brothers plant at Cata- niles a

on Sc nd Conveying Equipment talled plants—one of the reasons roth ions are noteworthy for ncy a ed by low maintenance r full on of these two plants.



Washing and screening plant at Catalina Island quarry.



ONFG. CO., Aurora, Illinois

FACTO LOS ANGELES

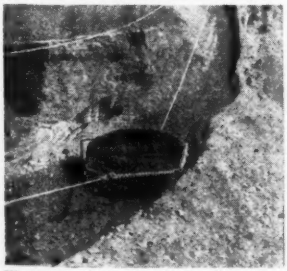
MATERIAL producers, as good business men, recognize the importance of keeping down their overhead expense. That is one reason why the Sauerman Crescent Power Drag Scraper has become the most popular equipment for sand and gravel pits.

The amount that the owner of a Crescent scraper has to charge off for interest, depreciation and maintenance is very low. So is his labor cost, for one man handles the entire excavating and conveying operation. Material is thus excavatel and placed in the plant at a minimum cost per yard.

Crescent scrapers show up particularly well when confronted with difficult digging, for they have great excavating power and are designed to stand up under the grief of daily operation in deposits of hard-packed material.

If you have an excavating problem to solve, it will pay you to lay the details before our engineers, who will offer an economical solution for your consideration based on what our equipment has accomplished on other similar excavating work. If you simply desire description of Crescent scrapers, write for Pamphlet No. 24.

CRESCENT
POWER DRAG SCRAPER
(Trade Mark Reg., U. S. Pat. Office)



The curved shape of the Crescent scraper makes it easy to pull and it cuts a straight and level path in the material it is digging. It picks a full load but cannot over-load.

SAUERMAN BROS., INC.
434 S. Clinton St., Chicago

SAUERMAN
SLACKLINE CABLEWAYS ‡ POWER DRAG SCRAPERS

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

- ☐ Agitators
- ☐ Air Compressors
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Baffles
- ☐ Bag Filling Machines
- ☐ Bag Sewing Mach.
- ☐ Bags, Cotton
- ☐ Bags, Paper
- ☐ Barges
- ☐ Barrels, Steel
- ☐ Belt Fasteners
- ☐ Belting, Conveyor
- ☐ Belting, Transmission
- ☐ Bin Gates
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- ☐ Bins, Steel Storage
- ☐ Blasting Fuses
- ☐ Blasting Powder
- ☐ Block Machinery, Concrete
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
- ☐ Brick Machinery, Concrete
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- ☐ Burners, Oil
- ☐ Cable Coatings
- ☐ Cableways
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- ☐ Car Pullers
- ☐ Car Replacers
- ☐ Car Wheels
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- ☐ Cars, End Dump (Gauge.....in.)
- ☐ Cars, Side Dump (Gauge.....in.)
- ☐ Cars, Steel Gondola
- ☐ Castings, Special Metal
- ☐ Chain Drive
- ☐ Chain, Conveyor
- ☐ Chain, Steam Shovel and Dredge
- ☐ Chaser Mills
- ☐ Chutes and Liners, Metal
- ☐ Classifiers
- ☐ Clips, Wire Rope
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- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Derrick Swingers
- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom

(Continued on next page)

- ☐ Dragline, Scraper
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Drill Steel
- ☐ Drilling Contractors
- ☐ Drill Sharpening Machines
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Dryers, Sand and Stone
- ☐ Dry Pans
- ☐ Dump Wagons
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Dynamos, Electric
- ☐ Economizers, Fuel
- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Gasoline (H. P.....)
- ☐ Engines, Gasoline Portable Power Unit (H. P.....)
- ☐ Engines, Hoisting
- ☐ Engines, Hydraulic Pumping
- ☐ Engines, Oil (H. P.....)
- ☐ Engines, Power Plant
- ☐ Engines, Steam
- ☐ Feeders
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- ☐ Fire Alarm Systems

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Firm Name.....

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- ☐ Pumps, Sand
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- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment

(See other side)

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- ☐ Separators, Gypsum
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- ☐ Tackle Blocks
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- ☐ Transformers, Electric
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- ☐ Wagons, Dump
- ☐ Washers, Log
- ☐ Washing Equipment
- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

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Pit and Quarry

Index to Advertisers

VOL. 1 CHICAGO, ILL., OCTOBER 15, 1925 NO. 2

113,000 Tons of Material---Less than 1/10 cent per Ton for Repairs

Wouldn't it be worth real money to you to be able to write this sort of a letter about your material handling?

"Our Brownhoist crane has handled approximately 66,000 tons of crushed stone and 47,000 tons of sand during the past three seasons. Our repair bill has been less than $100 including ropes, and from all appearances this crane will be good for ten years more," writes the Devine Construction Company, owners of this crane.

The small sum spent for repairs on a Brownhoist crane not only makes it an economical handling unit, but you are free from the breakdowns which are so costly and annoying to a contractor.

THE BROWN HOISTING MACHINERY CO.

Cleveland, Ohio

Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans, London, Eng.

BROWNHOIST

MATERIAL HANDLING MACHINERY

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. I CHICAGO, ILL., OCTOBER 15, 1925 NO. 2

FEATURE CONTENTS

Pass it on

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Vice-Pres. .....

Secretary .....

Treasurer .....

Gen. Mgr. .....

Sales Mgr. .....

Traffic Mgr. .....

Engineer .....

Supt. .....

Foreman .....

Purch. Agent .....

COMPLETE SERVICE PUBLISHING CO.
Rand-McNally Bldg., Chicago, Ill.
Publishers of
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HAROLD W. MUNDAY
Editor

Associate Editors
E. D. ROBERTS
GEORGE B. MASSEY

300 to 325 Yards in eight hour day

With the Bear Cat ½-Yard Shovel illustrated above, Mr. H. Opfer of Roslyn, New York, is getting 300 to 325 yards of sand and gravel in eight hours. The material is loaded into 5-ton trucks at the bank.

Now consider what this volume of digging costs the owner. The Bear Cat is operated by just one man, and his wages come to about one half of the total cost of operation. The Hercules 40 h.p. motor is economical of fuel, requiring only about 13 gallons of gasoline on the average for eight hours. Cables and other expenses are correspondingly low. Records of a large number of owners place the total operating cost between fifteen and sixteen dollars per day.

The picture above gives a good idea of the Bear Cat's rugged construction and the popular full caterpillar mounting which provides 100 per cent traction and stability.

Then remember that the Bear Cat is equally effective with clamshell, skimmer and ditcher attachments, all of which are interchangeable. Owners everywhere are finding it a wonderful buy for the money, far exceeding their expectations.

Let us send you the Bear Cat Book containing full description.

THE BYERS MACHINE COMPANY, Ravenna, Ohio

Builders also of Truckranes and 10-Ton Full Circle Cranes

Sales and Service Throughout the Country

BYERS BEAR CAT

THE ALL-PURPOSE ONE MAN CRANE

Pit and Quarry

Vol. 11 Chicago, Ill., October 15, 1925 No. 2

A Commendable Move

PLANS have been completed by the National Crushed Stone Association for the establishment of a Bureau of Engineering in Washington, D. C. The office of the Director of the Bureau as well as that of the Secretary of the Association will be in a suite of rooms in the Earle Building. Such a Bureau will unquestionably be of benefit not only to the industry but to construction in general.

The reasons prompting the Association to enter into this new form of activity are indicated in the following conception of the functions of the Bureau:

1. To review the facts which have been established in respect to crushed stone through field and laboratory tests in order that such facts may be made available and plainly set forth for the benefit of both producer and consumer.

2. To determine what characteristics of crushed stone require further investigation and to devise and suggest means whereby these characteristics may be determined and finally written into specifications.

3. To stimulate thorough testing of aggregates in various government, state and collegiate laboratories, as well as in the field and to render such proper assistance as may be desired in carrying out such investigations.

4. To interpret the results of researches on aggregates in an unbiased, straightforward manner to the end that there will be no misunderstanding of the limitations and meaning of research results in the minds of the users or producers.

5. To disseminate such facts as may become available from time to time as researches are brought to conclusion or as progress reports are issued. Technical articles, Associations bulletins, the presentation of technical papers, as well as personal contact, will be used as means for conveying helpful information to those interested.

A. T. Goldbeck

6. To be of as much assistance as may be possible and desirable to state and municipal highway departments in all their problems involving the use of aggregates.

7. To represent the interests of crushed stone on technical committees writing specifications for aggregates.

8. To discover and disseminate information concerning uses for that portion of the product now largely wasted and so relieve the salable portion of a then unnecessary cost burden. This, if successful, will greatly benefit both producer and consumer.

9. To disseminate such data as may become a v a i l a b l e on production

methods, to the end that economies may be effected.

10. Through co-operation with engineering groups to attempt to bring simplification of sizes, thus leading to economies in production.

11. To co-operate with other agencies to approach more nearly an equalization of seasonal construction of all sorts, to the end that more constant production may result, thereby leaving to the benefit of producer and consumer the peak loads which now occur through the production season.

12. To extend all possible aid to bring about a better understanding between producer and consumer to the end that the desires of each will be more thoroughly understood and worked out in as practical a way as circumstances permit.

13. To study the uses of aggregates for all forms of construction from the standpoint of their relative economy and value.

14. In general, to advance the interests of crushed stone in a frank, straightforward, scientific and ethical manner, free from bias and without recourse to unworthy attacks on any other aggregates.

We are assured that these functions of the Bureau will be carried out by Mr. A. T. Goldbeck, at present Chief of the Division of Tests of the United States Bureau of Public Roads, who will act as Director of the Bureau. Mr. Goldbeck is known throughout the country as a distinguished engineer, particularly in his chosen line of testing materials. After graduating from the civil engineering department of the University of Pennsylvania in 1906, he engaged for several years in teaching mechanics of materials and testing materials at his Alma Mater and at Lafayette College. In 1910 he left Lafayette to join the personnel of the office of Public Roads in Washington as Engineer of Tests and held this position for three years. At the conclusion of this period and until 1915, he was assistant engineer in charge of the Municipal Laboratory of the City of Philadelphia. He then returned to the reorganized Office of Public Roads as Engineer of Tests in work of a greatly enlarged scope. During the past six years he has been Chief of the Division of Tests of the Bureau in charge of all tests and investigations, with from sixty to eighty employees, conducting investigations on bituminous and non-bituminous road materials in the laboratory and field, on subgrade materials, and on important bridge researches. The annual expenditure for this work has been approximately a quarter of a million dollars. He has originated testing equipment, some of which is used throughout the world. He is largely responsible for the soil pressure measuring cell which bears his name and which has been widely used for measuring earth pressures on various structures. He has also developed a frequently used graphic strain gauge for investigation of stresses in concrete, as well as various other pieces of apparatus.

The National Crushed Stone Association is indeed fortunate in being able to secure the services of Mr. Goldbeck. His ability, character and integrity are such as will assure a scholarly and scientific treatment of all problems brought to him for consideration.

The office of the Secretary of the Association, which was formerly in Columbus, Ohio, will be in offices adjacent to the Director of the Bureau of Engineering, the new Secretary being Mr. J. R. Boyd. Mr. Boyd is a graduate engineer, having attended night classes in George Washington University. For the past six or seven years Mr. Boyd has been an assistant engineer of testing in the United States Bureau of Public Roads, and has worked in close co-operation with Mr. Goldbeck. He is Chairman of the Committee on Subgrades of the State Highway Officials Association, and his research along this line of endeavor has attracted national attention. It is believed that the joint offices in Washington will be not only of value to the industry but of service to engineers, architects and highway builders.

Scientific research is a great influence in the Cement, Lime and Gypsum industries. It will be an influence in the Crushed Stone Industry. It would be an influence in the Sand and Gravel Industry. Many industries, where less than $300,000,000 is invested in capital, have benefited by research. There has been evidence for the past few years that scientific research was needed in the Crushed Stone Industry. The announcement of the establishment of this bureau is most opportune.

The Pioneer Wet Process Cement Plant On the North American Continent

By E. D. Roberts

MANUFACTURE of Portland cement on the American Continent in a plant, built wholly for making cement from hard raw materials by the wet process, was first accomplished by the Olympic Portland Cement Company, Ltd., at Bellingham, Washington, in the year 1915. That this plant should still be up to date as well as the first in the country wholly using the wet process shows that the designers were far-sighted and that they know how to manufacture cement practically and economically.

The cement plant is located on Bellingham Bay alongside the main line of the Great Northern Railroad about two miles from the center of the City of Bellingham, Washington. The plant is also served by the Chicago Milwaukee and St. Paul Railway and the Northern Pacific Railroad. The Marionette Road, the main paved road running north from Bellingham passes the plant on the east. Company tracks, reaching out into the Bay for 2300 feet on their own dock, afford shipping facilities by ocean steamer or by barge to points on Puget Sound. Coal is mined locally. A plentiful supply of raw materials is within easy reach. This combination of favorable circumstances, coupled with a plentiful supply of labor, prompted the construction of the plant at this point.

Lime rock is secured at Balfour which is about 30 miles east of Bellingham on the Chicago Milwaukee and St. Paul railroad. Hydraulic giants strip the rock of the overlying dirt and debris. The rock is then shot and loaded by a Marion steam shovel into dump cars. The rock is dumped into a Fairmont crusher

The Balfour Quarry of the Olympic Portland Cement Company

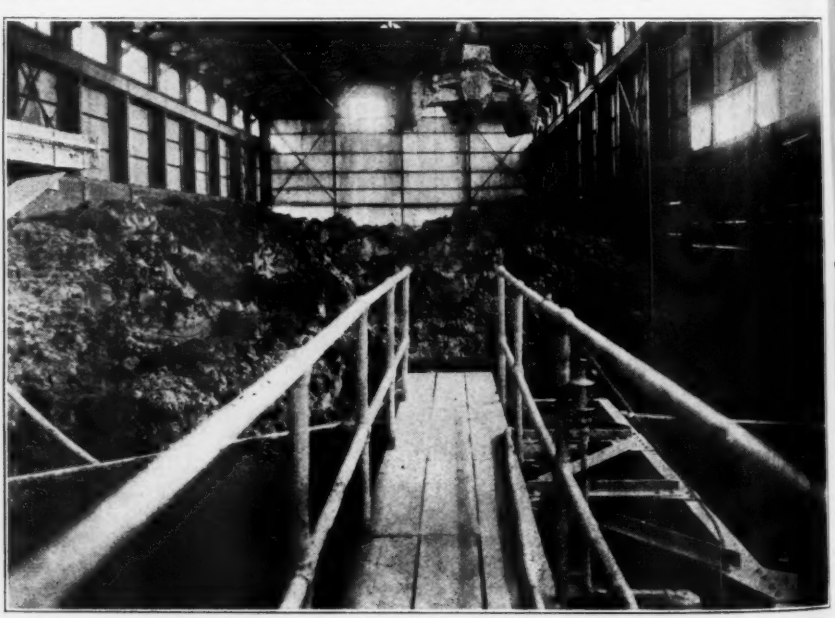
which reduces it to a 3 inch maximum. A Williams pulverizing mill reduces it still further to a 1 inch maximum discharging the rock into a bin. The Olympic Portland Cement Company maintains a switch engine of their own to load the standard railroad cars with the rock for shipment to the mill at Bellingham. The railroad company has assigned 42 fifty-ton bottom dump gondolas for this service, which insures an adequate supply of cars at all times.

Clay is secured from a point five miles north. Here the clay is loaded into standard railroad cars by a locomotive crane using an orange peel bucket. The cars containing the clay are spotted opposite the clay storage building at the mill and unloaded by an overhead electric crane using an orange peel bucket. This crane also handles the clay into the wash mill. While unloading the incoming cars, as much clay as possible is unloaded directly into the wash mill to save rehandling.

The wash mill thoroughly mixes the clay with water until the mass resembles a syrupy mixture. It is then drawn off for screening and discharged into a storage basin in which it is kept agitated. Double plunger pumps lift the washed clay to the feeders of the three wet kominuters. An excess is pumped which flows back by gravity to the storage basin. The wash mill and agitating machinery were designed by F. L. Smidth Company and they also furnished the kominuters.

The limerock arrives in cars which are spotted for unloading by the company's own switch engine. A long trestle under a shed allows the rock to be bottom dumped from the cars into the covered storage space below. This building has a capacity for 9,000 tons of rock. A 20-inch belt conveyor is operated in a tunnel below the rock pile. The rock drops onto the belt through hoppered openings equipped with slide gates. The belt conveyor carries the rock to and discharges it onto a boot pit. This inclined bucket elevator raises the rock to the top of the building and discharges it onto a Link Belt Conveyor. This Link-Belt conveyor distributes the rock into the raw mill bins. Rocker arm feeders control the flow of the rock to the kominuters, where it is mixed with the clay and water. The proportions are about 3¾ parts of rock to 1 part of clay while water constitutes 34 per cent of the whole.

This has brought the two main ingredients together in one of the three kominuters that give the material



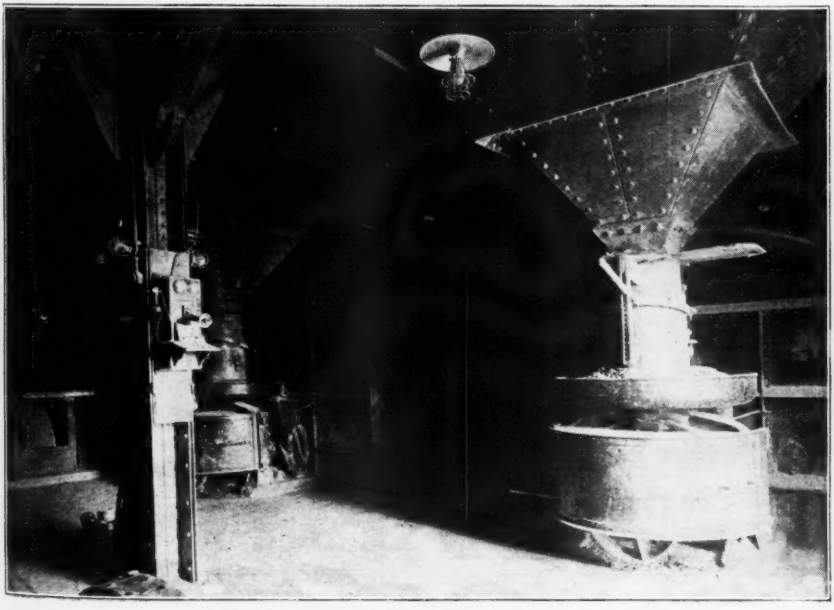
Interior of Raw Storage Building Showing Clay Storage

the first mill grinding. The discharge from the kominuters is elevated to a trix separator that allows the fines to pass on to the tube mills and returns the coarse particles to the kominuters for regrinding. Both returns are made through pipes by gravity. All of the finely ground material then passes through a 7 by 22 foot F. L. Smidth tube mill that gives the material a still further reduction, after which two 6 foot 6 inch by 10 foot tube mills divide the load and complete the raw grinding. The discharge from the tube mills is conveyed to any one of the three correcting basins and discharged to them. The large tube mill is operated by a 200 horse power General Electric motor and the small tube mills by 100 horse power motors of the same manufacture. The speed reduction is made through a Lenix drive in each case.

The slurry is drawn from the three correcting basins by gravity into a mixing basin. This procedure is controlled by the chemist, who uses this means to secure the proper mix for burning. An Ingersoll-Rand air lift pump delivers the slurry to the two kiln feed tanks. The slurry is then pumped from the kiln basins to the kiln feeders, which control the flow of material into the kilns. This slurry is kept in a creamy state by means of mechanical agitators in each of the basins.

Two Vulcan kilns, each 170 feet long and 9 feet in diameter at the feed end and enlarged to 10 feet in diameter throughout the burning zone, dry the slurry and then burn it to clinker. Each kiln is operated by a 50 horse power General Electric variable speed motor through belt drives. The switches and controls for these motors are located at the operator's end of the kiln. Powdered coal is the fuel used for burning. After being discharged from the kiln, the clinker falls through a passageway to a 40 foot F. L. Smidth pressure cooler, one under each kiln. The clinker travels the length of the cooler on the inside and returns part way in a passageway between an inner and outer shell. Air for cooling is furnished by an American blower, which forces the air through the cooler in the opposite direction to that traversed by the clinker. That part of the air required for operation of the kiln is used in its heated state and the balance allowed to escape.

Both coolers discharge into a common Link Belt conveyor that carries the cooled clinker to the clinker storage building. After elevating it is discharged onto piles in the building



Interior View Showing Kominuters

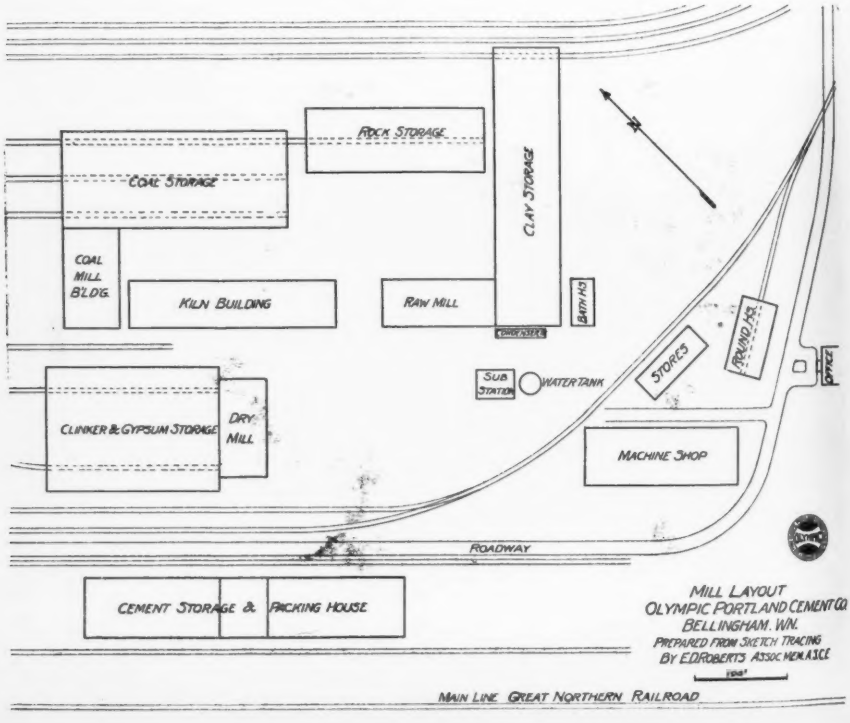
for mixing by a 15-ton Bay City locomotive crane. The Olympic Portland Cement Company has found that fresh clinker mixed with aged clinker in equal proporitons is easier to grind than fresh clinker only as it comes from the cooler. A reclaiming conveyor operating under the clinker storage transports the mixed clinker to the dry mill, where it is elevated to the clinker bins, which are located in the top of the dry mill building.

The Bay City crane used for mixing clinker also unloads the incoming gypsum from the railroad cars onto a pile in the clinker storage building or into a hopper over the reclaiming conveyor under the clinker storage. This reclaiming conveyor carries the gypsum to the dry mill, where it is elevated to a gypsum bin located alongside the clinker bins.

Proportioning of the finished product is done by spotting a steel car under the discharge spouts from the clinker and gypsum bins and drawing off the proper proportions of each into the car. The car is moved by hand a few feet and dumped into the kominuter feed bins located directly over the feeders of the kominuters. Two number 85 F. L. Smidth kominuters perform the first stage of the finish grinding. Various sized balls are used for the grinding agents.

Discharged from the kominuters into a common screw conveyor, the partially ground cement is carried to an elevator which discharges into a screw conveyor operating over the two tube mill feed bins. Two number 18 tube mills complete the grinding of the cement, using cylpebs for the charge. Motors of 100 horse power are required to operate each kominuter and 200 horse power motors are used on each of the tube mills. The clinker, gypsum, kominuter, and tube mill bins are constructed of structural steel beams and plates. The bins are placed side by side wherever possible to conserve space and steel.

A screw conveyor operating under the discharge from each tube mill carries the cement to the end of the dry mill building. Here it is discharged onto a belt conveyor, set at an angle of 30 degrees, which elevates the cement to the top of the

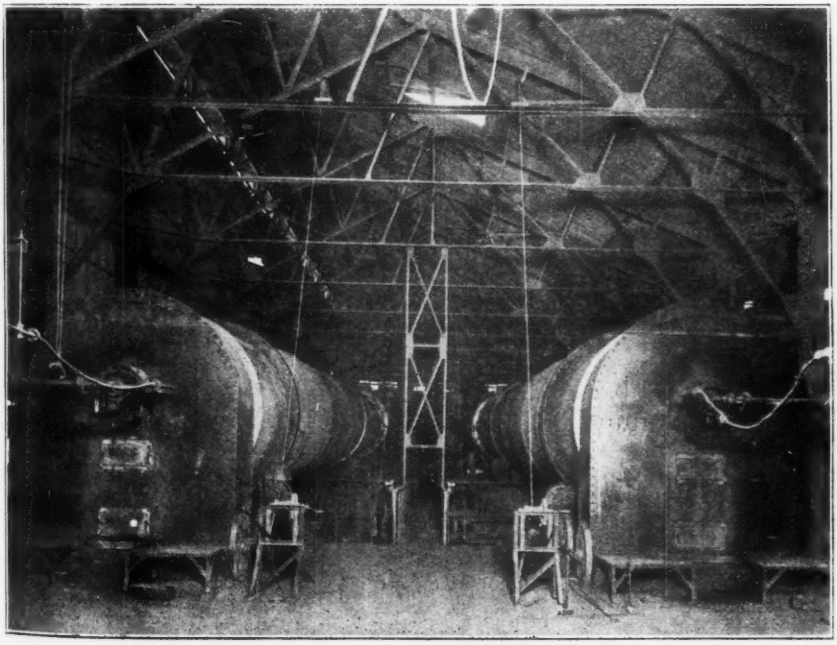


storage silos and discharges it into a screw conveyor, which distributes the cement to the various silos. There are 10 silos, each holding 10,000 barrels of cement. They are arranged in two groups on each side of the bag and packing house, which is directly under the inclined belt conveyor coming from the dry mill to the silos.

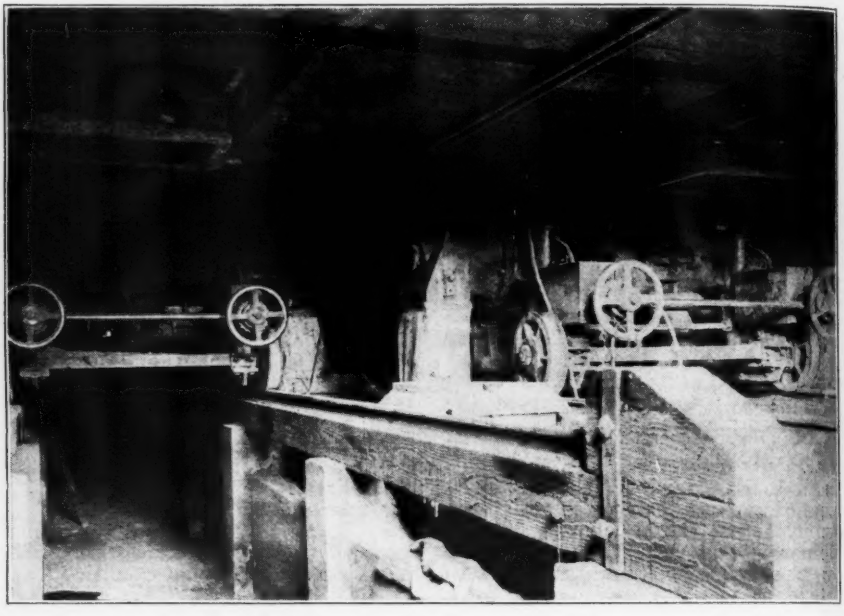
A machine, called an Xbiner, which is an F. L. Smidth product, draws the cement from the silos and discharges it into a screw conveyor operating in a tunnel underneath the row of silos. There are two of these machines and they travel on their own tracks and discharge into the same screw conveyor. The Xbiner is connected to an opening in the bottom of the silo and the slide withdrawn. The cement falls into a screw that feeds the cement into the longitudinal conveyor without floods or escape of cement dust. A motor direct connected to the machinery of the Xbiner and mounted on the carriage or the machine operates it. An attendant is not required constantly in the tunnel to operate the Xbiners. After connecting it to the proper bin, the operator goes back to the packing house for other work. After going through several tunnels where there was a deafening din, caused by the pounding on the pipes leading from the bins to the conveyor, it was a treat to go through this tunnel where you could talk and be understood and where you did not have to dodge spurts of cement caused by flooding of the pipes.

An elevator takes the cement discharged from the screw conveyor and elevates it to the top of the packing house and there discharges it into a screw that screens the cement and then discharges it into the large steel bins over the Bates 4-tube packers. These steel bins have circular bottoms with the packers connected to the lower part. There are two such bins with two Bates packers under each, with provisions for additional packers and for packing in barrels if desired. Spill elevators reclaim the cement spilled in sacking and return it to the screen and packing later. Dust collectors keep the packing house in a livable condition.

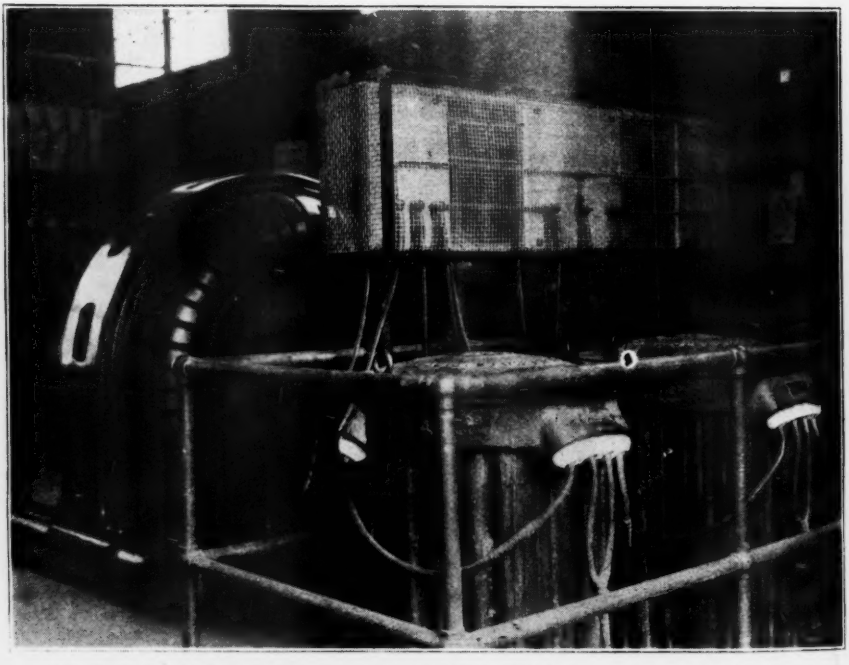
The sacked cement falls onto belt conveyors that discharge into trucks onto the cars spotted on tracks alongside each side of the packing house. It is possible to load 4000 barrels of



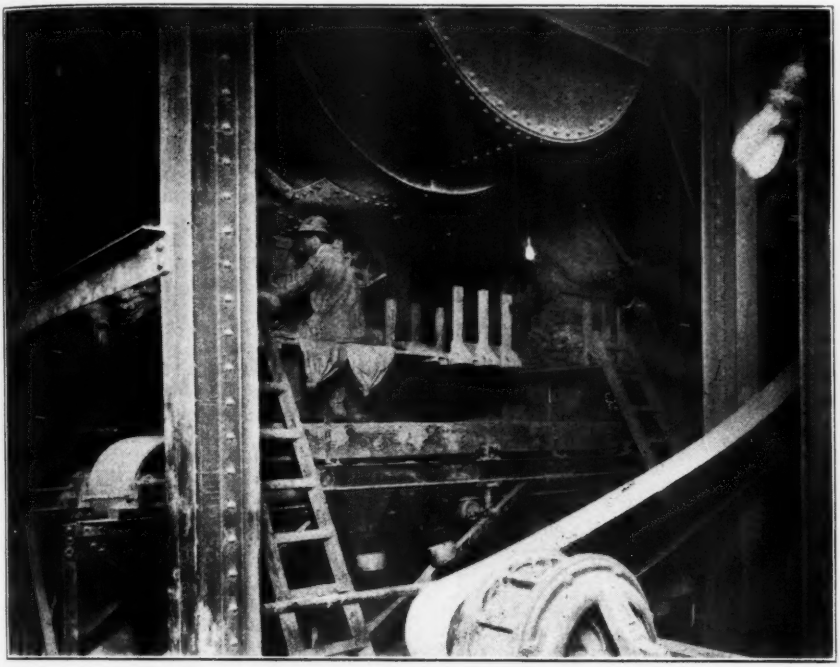
The Two 170 Foot Kilns



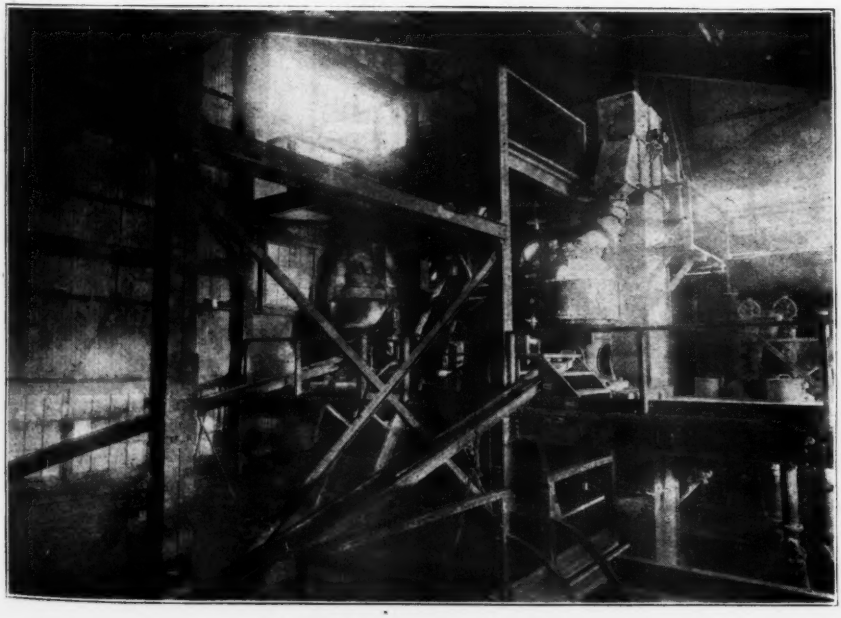
The Xbiners Drawing Cement from Silos



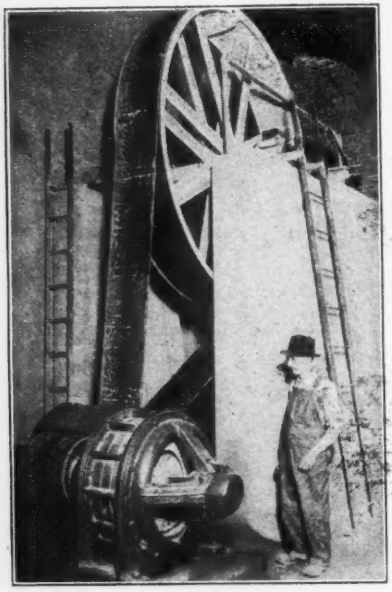
Interior View in Switch House showing a Guard Which Is Typical of Safety Policy



The Tank Feed to Bates Packers



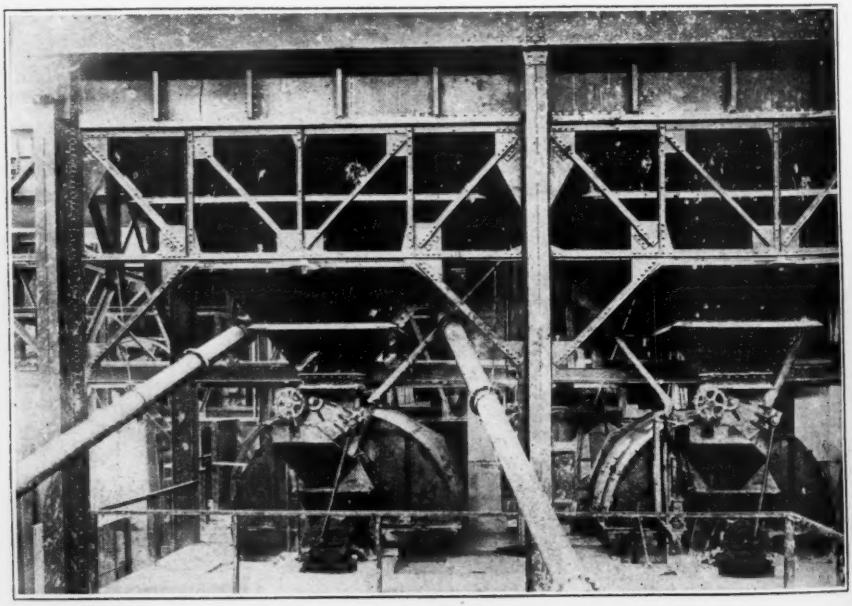
Interior View Showing Trix Mills



The Lenix Drive

cement on a single switch. The company owns its own cars for handling this amount of cement to the dock for loading onto barges or ocean steamers. This saves railroad charges and insures enough cars to handle a cargo of cement when the boat can call for it. A switch engine owned by the cement company handles the cars to the dock as well as doing any switching required throughout the plant.

Fuel oil was originally used for calcining the clinker, but, in 1918 a coal pulverizing plant was installed replacing the oil for kiln fuel. The oil installation is still in place for use in case an emergency should arise. Bellingham coal is secured at a very low cost from the nearby mines and brought in the plant by railroad. A coal storage shed was constructed from the coal mill building over to and covering the track to the rock storage. This track is built on a trestle above the plant level, affording an opportunity to dump the cars by gravity. An inclined apron conveyor was constructed under the track throughout the length of the coal storage shed, onto which the coal is dumped through the tracks from bottom dump gondolas and deflected towards the coal mill building. Tracks in the shed on the ground level provide a means for the coal to be reclaimed by a locomotive crane. This crane loads the coal into bottom dump cars for dumping into the coal mill hop-



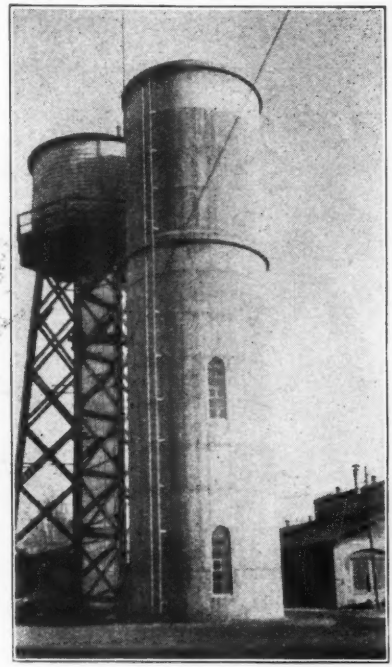
The Clay Feed

per. Incoming coal is dumped directly into the mill hopper if possible to save the extra handling.

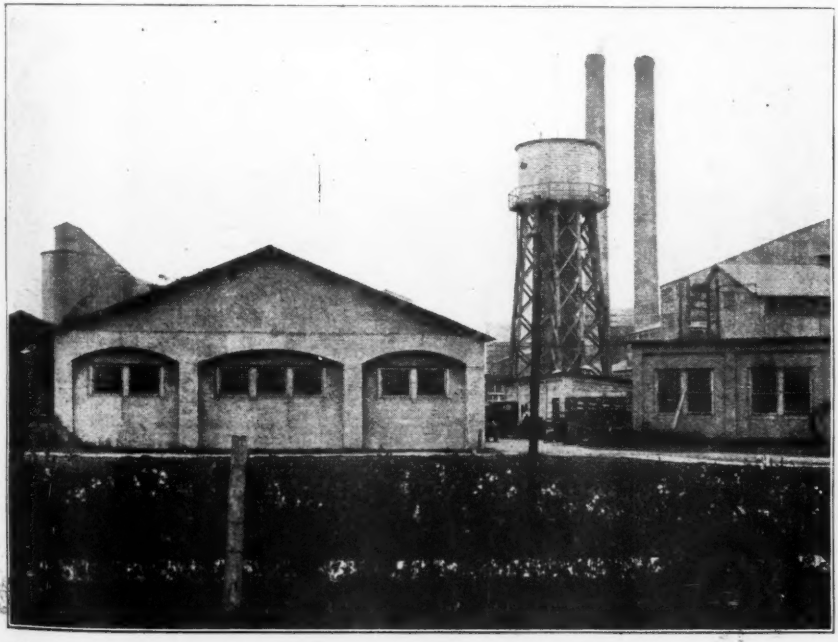
The coal is elevated from the hopper to the wet coal bin over the dryer, from which it is fed to the dryer by a feeder. After passing through the Cummer dryer it is given a two stage grinding. First it goes through a kominuter and then through a tube mill. The powdered coal is conveyed to the kiln feed bins in the kiln building.

The dryer fuel is the raw coal fed through automatic stokers to the fire box. Air for drying the coal is drawn in through the fire, traversing the length of the dryer on the outside of the shell carrying the coal. An exhauster fan discharges the air to a double stage set of cyclone dust collectors that cleanse the air before allowing it to escape.

The kiln feed coal tanks have a capacity of ten tons of powdered coal each. There is one tank for each kiln equipped with independent units for feeding the coal to the kilns. The feeding is done by a screw conveyor operated so as to draw coal from the bin. A Smidth variable speed friction device allows the burner to change the rate of feed as desired.



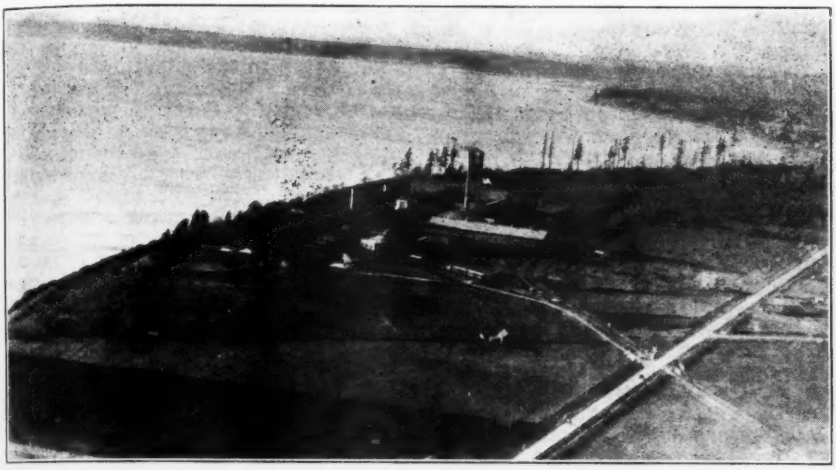
Reinforced Concrete Water Tank



View of Plant Buildings—Note the Sweet Peas Along the Fence and the General Neatness of Grounds

View Showing How Trees Thrive Around the Plant

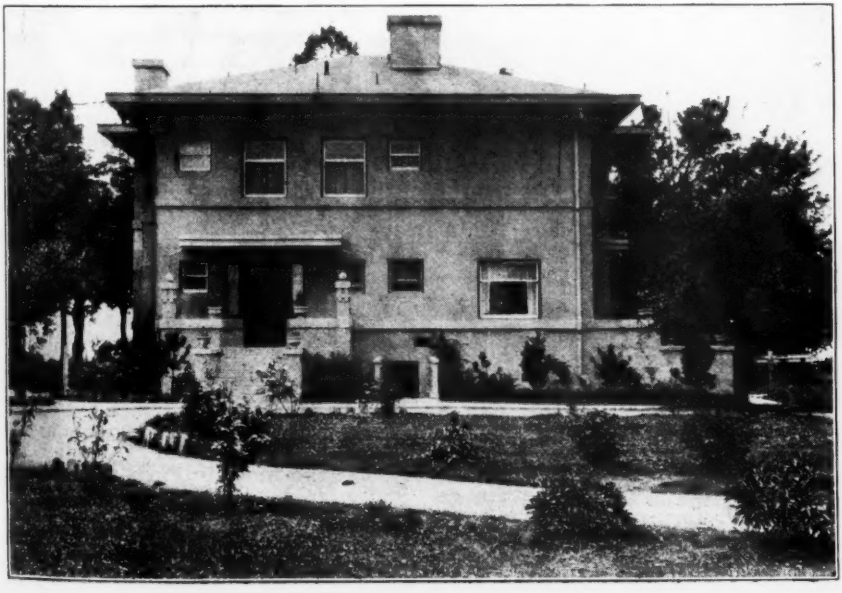
The Approach to the Plant



Airplane View Showing Plant and Harbor

The feeder screw discharges into a pipe through which a blower is forcing air into the kilns. This stream of air carries the coal into the kiln and projects it into the burning zone. The air for the operation is furnished by a Garden City fan.

F. L. Smidth and Company designed and supervised the construction of the plant for the owners. Provisions have been made in the original plans for increasing the plant from a 2 kiln plant to a 6 kiln plant, which would be three times the present capacity. The level site has favored an excellent track layout. All trackage is owned by the cement company and is interconnected with a suitable switching arrangement at each end of the plant



The Reinforced Concrete House of the Superintendent

for easy handling of cars throughout the plant entirely on their own tracks.

A large reinforced concrete water tank built by running up a set of silo forms and flooring across at the desired point supplies the water for plant use. A condensing tank is used for supplying circulating water to bearings, etc., and cuts down the amount of pumping necessary. Electric power for plant operation is secured from the Puget Sound Light and Traction Company, and stepped down to plant voltage in a sub station at the plant. Reinforced concrete machine shop and storehouse buildings well equipped for caring for the needs of the plant are conveniently located to the main parts of the plant. The office is also of reinforced concrete and located on the roadway entering the plant. A large, commodious washroom and shower bath is provided for the use of the employees in a building which is devoted to the use of the employees as they wish.

Mr. A. F. Krabbe, the superintendent of the plant, takes great pride in its appearance. All of the open space between the buildings not used for walkways, roadways or trackage has been turned into lawn and is kept in excellent condition. Flowers are growing everywhere, which together with the great variety of trees that are in excellent condition are evident that there is no damage being done around this plant from cement dust.

The company has constructed a large, commodious reinforced concrete house for the use of the superintendent. It is located in a grove of trees between the office and the Bay.

The Olympic Portland Cement Company, Limited, has its main office in London, England, where Mr. Williamson, the Chairman of the Board, and Mr. Ross, the Secretary, reside. Mr. A. F. Krabbe is manager and superintendent of the plant. His home and office are at the plant.

Gravel Plant Suffers Fire Loss

The office building of the Northern Indiana Sand and Gravel Company was completely destroyed by fire recently. Mystery surrounds the cause of the fire. A shotgun which was kept in the office was removed before the fire and offers the only clue to the local authorities.

Cement Retarders

There is a wide difference of opinion as to the adaptability of anhydrite as a substitute for gypsum as a retarder for Portland cement. At present gypsum is commonly used for retarder in cement, on account of its cheapness, although it is known that plaster of Paris will retard cement, and that anhydrite has a retarding effect. The problem is of importance as many gypsum quarries are encountering anhydrite mixed with the gypsum in the deeper parts of the bed. In order to obtain definite information on the properties of anhydrite, gypsum and plaster of Paris, exhaustive tests have been conducted by chemists of the Bureau of Mines, Department of Commerce, with about 20 different Portland cements, using pure anhydrite and mixtures of anhydrite with gypsum and plaster of Paris. It was found that pure anhydrite is a poor retarder, but some of its mixtures gave very good results. The best results as to setting qualities, strength, and plasticity were obtained with mixtures of gypsum and plaster of Paris. Several fundamental principles governing cement retardation were established by the tests. This work was conducted by the Bureau of Mines in cooperation with and at the request of the cement and gypsum industries. The results are to be used as a basis for tests by the companies on a large scale.

Stillwell Sand and Gravel Sold

The sale af the Stillwell Sand and Gravel Company to M. A. Mavielle of Indianapolis has been completed. The new owner, who has taken possession, was reported to have paid for stock to the sum of $150,000, which was surrendered by the former owners, Thomas N. Stillwell, Ernest W. Hill, Rex Kaufman and Wade H. Free.

The deal included all of the company's property and equipment except an addition of seventy-two lots southeast of the Stillwell Company pit along the Mounds Park road, which were sold to Charles E. Willson, general manager of the Remy Electric Company for $10,000. The deed was reported to have been made to Fred S. Kimmerling, director of production control at the Remy factory.

Blasting and the Use of Explosives

By F. F. McLaughlin, Blasting Engineer, France Stone Company*

HIGH explosives have become one of the great servants of our present civilization. Like other great giants in man's service such as steam, electricity, air, and fire, explosive effort must be directed and controlled lest harm, instead of good, be a result of its use. The control of any great energy is largely a matter of preparation for the direction of its effort. In other words, it is a matter of our driving the team instead of the team driving us.

Blasting is usually viewed as a necessary evil in the operation of a quarry—the war department of the industry, as it were. Every year a large number of blasting accidents occur, resulting in injury and death to many men. Because the accidents usually destroy the evidence, the actual causes of many blasting accidents are never fully determined; but, with few exceptions, a check on the previous conditions plus the results of an accident will prove that men, and not the explosives, primarily were the cause for disaster. If this statement is true, our hope of preventing blasting accidents is well founded. A man can be trained —a case of explosive cannot direct itself.

There is no such thing as a "safe" high explosive. We buy it and use it for what it is—an enormous potential energy chemically stored and harnessed for our service. We may as sensibly expect to avoid the natural results of contact with a high tension power line as to abort the known laws governing explosives and get away with a whole skin.

In face of all the death and injury incident to the use of explosives it is folly to expect to find some easy road of escape from the hazard. But blasting accidents are preventable. They are caused by ignorance, carelessness, and by the miscellaneous item called "the act of God." I put ignorance at the head of the list, and the densest comparative ignorance lies with the executive who hasn't sense enough to be afraid for himself and his men when he isn't sure of the right thing to do in blasting practice. Not many average working men are intentionally careless with explosives. They are afraid of it, and usually seek to get a blast over with as quickly as possible. Their ignorance, which created their fear and haste, produces a treble possibility for trouble. Haste is never a good tool for a normal job, and blasting can be made a normal part of your quarry operation. Therefore, neither haste nor ignorance has any place in safe, efficient, use of explosives.

High explosives will normally follow and be governed by fairly well known laws. It is an inanimate material, and can be controlled. Let us then really educate ourselves about this material and its use that we may avoid accidents and forget our fear of its use and power.

Our government, through the Bureau of Mines, our states, through their various industrial commissions, the various explosive manufacturers, and our trade magazines will lay before us, for the asking, the work of literally hundreds of men who have labored on this subject for our benefit. The purchase price of safety for you and your men is only ordinarily a letter stating your wants and some common sense to interpret in your particular quarry what you will be told about explosives.

Lest some may think that blasting accidents are more largely caused by the material used than by a lack in the direction of its use, a word will be said here about the manufacture of explosives. It is a far cry from Nobel's simple mixture of nitrated glycerin and fuller's earth to the perfected, controlled, high explosive of today. The unflagging effort of each generation of powder makers has reached a yet higher step in the progress of understanding and safety in the manufacture and use of explosives. Probably no other body of manufacturers so extend their interest beyond the manufacture and sale of their product as do the producers of explosives. As if in obedience to the old Christian code, where we would have them go a mile with us they have gladly gone two miles. They make every conceivable effort to protect a troublesme business from

*A paper presented on September 30, 1925, before the joint meeting of the Cement and Quarry Sections at the National Safety Congress held in Cleveland.

trouble. No explosive manufacturer can, for reasons that are clear, afford to have a series of disastrous events connected with his product. The Bureau of Mines constantly checks explosive products to keep the manufacturer from error even though his own company check through rule, laboratory, and supervision. The Bureau for the Sale Transportation of Explosives is another government agency that specifies details for explosive packing and transportation, specifying even the kind of car explosives may be shipped in. The railroads are instructed to expedite delivery and discharge of the contents of a car of explosives. Nine thousand, nine hundred, ninety-nine times in ten thousand explosive shipments reach your plant siding practically as good as when they left the factory. This being the case, the arrival of the car on your siding ends the real responsibility of the manufacturer and the transportation company and your responsibility begins.

Every honest manager or superintendent wants to do the right thing. We err through lack of information. The long, safe, way is the shortest good road between the two points involved. Take some thought about the hazards of fire and collision when locating the car for unloading, and about the course your wagon, truck, or men must take in transferring the cases from the car to the magazine. If it is wise for the manufacturer and our government to be concerned about these details it is foolish for us not to follow their example. Have a good road from the car to the magazine, and from the magazine to the quarry face. We have the men and material needed right at hand with which to build the best roads in the country. Not only is a good road an attraction to a visitor at your plant, not only does it reflect your own pride and neatness around the job, but it pays a real dividend, especially in bad weather. It is safe to transport cased explosives in a clean truck on a good road. Remember that you cannot know the exact condition of the contents of a case of explosives until the case is opened. Electric exploders and blasting caps should be handled like a crate of eggs, while powder fuse and cordeau will stand rougher treatment. As a rule don't jolt or jar explosives any more than absolutely necessary. Never toss or throw them, and be careful about the surface on which you slide them.

The chemicals of many explosives deteriorate with age, and this tends to make them more and more insensitive to ordinary methods of detonation. This in turn leads to misfires in the blast. As far as possible, keep your explosives stock fresh —not over six months old. Many explosives deteriorate when allowed to become damp, or too hot or cold. Equip your plant with a clean, dry, well ventilated storage magazine located and erected to comply with the laws of your state. Keep explosives in a magazine separate from detonators of any sort. The government regulations applying to the packing of explosives require the manufacturer to rightly mark the boxes "this side up." They do not so mark the boxes in order to play a joke on you. "This side up" means up, not down, nor on the side, nor end. Store them in the magazine as instructed. A second magazine is necessary in which to store detonators, and indeed should embody all the virtues of a main explosives magazine. Have magazines large enough, but don't order more than you can store for there is no other place "just as good" in which to store the excess. Poor storage will cost you much money in impaired efficiency of the explosives and will considerably increase your chances for blasting accidents due to the changed condition of the explosive under poor storage. This applies to fuse and caps as well as to the explosive proper.

I want to make a few statements here about frozen or hardened explosives. Don't use explosives when in such condition! And don't thaw them, either, for most folks don't know the chemical they are trying to bring out of a congealed state in the thawing process. It takes an explosive chemist to be safe during such an operation. If it is necessary for you to store and use explosives in low temperatures there are manufacturers ready to supply you with a practically non-freezing explosive of many types. Don't use and don't thaw frozen or hardened explosives! Be suspicious of explosives that have a tendency to "stiffen up" in temperatures below forty degrees Fahrenheit to the point of making a practice of testing each cartridge used by gently trying to insert a small round wooden peg in the middle and at

each end of the cartridge. If the peg meets resistance the explosive is in no condition to be used from either the viewpoint of efficiency or safety. A very large portion of the total of blasting accidents can be traced directly to the attempted use of frozen explosives.

If you were to make a bank blast today, yesterday was the right time to start it. By this is meant that intelligent preparation for a blast is, in itself, a large factor of safety. Blasting cannot be rightly accomplished without preparation. Be sensible about blasting, not fearful. Be deliberate. Take time and forethought to plan the details of a blast even more thoroughly than you plan the other major details of your quarry operation. Clean the bore holes to be used, even if it means taking the drill to do it. Clean away the loose stone from around the top of the holes. Run the drill tools down to the bottom of each hole, knocking down any lodged stone or wood in the hole, and spudding up the cuttings that have settled to the bottom. Bail the holes thoroughly, removing all the water possible. Some kinds of explosives decrease in efficiency very rapidly under contact with water, and this fact is a prolific source of misfired charges. If you don't already know how, get some experienced explosive man to show you how to measure the width, space, and depth that determine the tons of burden of each bore hole. This information, plus your own experience in blasting your bank, will enable you to almost exactly determine the amount of explosive required for each separate hole so that when delivering the explosive from the magazine to the bank you can place the amount needed adjacent to each bore hole. The importance of this practice is mentioned later. See that the top surface of the blast is clear of the odds and ends that gather from drilling and stripping operations. You can't blame your men for stumbling and falling if they are compelled to move around in the midst of a lot of debris. Clear the shot and adjacent surface of electric power lines that are near the surface, especially when electric blasting caps are to be used. Whenever possible clean away the bottom of the face ahead of the shot before loading any holes. **For a hole to explode, from any cause, with men working in front of the face of the shot, means almost certain death to those men.** See that all the tools are on hand, and in good shape, that are usually required in loading bore holes on your quarry bank. Use only wooden tools—wooden tamping poles without exposed metal, a wooden peg spliced on a rope for lowering cartridges in the hole, a round wooden peg twelve or fourteen inches long for making hole in cartridges through which to lace detonators, a wooden mallet with which to open boxes, and a wooden box to hold detonators until used. Such preparation will go a long way toward inspiring confidence on the job.

An old Chinese adage reads: "He who rises late must trot all day." It is wise to get an early start loading bore holes with explosives. It is cooler early in the morning, heads are usually clearer, and the explosives will not have to remain so long in the sun on a hot day. Also, you won't be pressed for time in finishing the job. Don't hurry. You are spending quite a sum of money in explosives, drilling, and labor. You must think as well as work. Take time to protect your investment, and you will be taking the safe, sane, sensible course. There ought to be one man on every shot to do nothing but watch the workmen. The material will do nothing of its own accord. It is eternally the men that get into trouble with the material. If possible do not have the process of loading more than one hole at a time. This concentration makes security and efficiency possible, while their value is divided by the number of holes being loaded at the same time. Do not have any more men working on the blast than are absolutely necessary. Eliminate the guesser, the chance-taker, the curious visitor, the smoker, hobnailed shoes, and matches.

Open the cases of explosives and detonators only as they are used, hole by hole. The cartridges are less exposed to sparks, heat, and cold in the cases than they are out of them. Open the cases only with a wooden mallet, and when opened do not dump the contents on the ground. A little wind blows the sawdust packing in the men's eyes, a little spark sets the paper afire—and there you are with a possible accident looming up. **Lift the cartridges from the box and lay them by the hole being loaded.**

You can then remove the box, paper, sawdust and all intact away from the shot. Do not start to load a hole until you are safe from sparks and lightning or stray electric currents. If a storm arises call your men to a point of safety away from the shot, and stay away until the storm has passed. Lightning will burn, explode, or detonate blasting caps, cordeau, and explosives. Inspect each bore hole just before loading it and see that it is a clear hole without obstructions to the bottom. A lodged piece of wood or a projecting stone in the hole means a jammed cartridge, and a consequent hazard created by trying to dislodge the cartridge. Your blaster is no vertical William Tell. I am not prepared to say just how far various explosives can be safely dropped in a bore hole, but by past experiences I am prepared to say "don't drop it at all." It isn't necessary to drop it. Use a wooden peg hung on a rope, pushing the peg into the cartridge till friction holds it, and lower the cartridge with this tool down the bore hole.

When the cartridge is seated where you want it, a slight, sharp, jerk will release the peg from the cartridge so that it can be drawn again to the top and the performance repeated until the hole is loaded. This loading practice does three things for you:—it gets away from serious friction against explosive matter deposited on the walls of the bore hole as each succeeding cartridge is dropped; by means of measured knots or other marks on the length of the rope you can exactly determine where each cartridge is located; it avoids the possibility of jamming the cartridges in the hole and the consequent practice of dislodging the "hung" cartridge. A jammed or hung cartridge is probably the greatest single ally of the undertaker encountered in the use of explosives. Even the use of a wooden pole is no insurance when you poke and push and hammer away at a hung cartridge trying to dislodge it and force it on down into the hole. Often the detonator is cut in the above process. It is better to lose the hole than to treat a cartridge roughly. It is still better to avoid paying both penalties by lowering the explosive instead of trying to drop it in the hole. Again, I confess, I am not prepared to say just how much tamping can be safely done on various explosives, but I am prepared, by experience, and in the interest of safety to say: do not tamp it at all. To tamp stemming in a bore hole is one thing, and quite all right if the detonator is not disturbed, but to tamp explosives is to freely invite the pall-bearers and the preacher to your funeral. I know that some of you can tell me how many hundreds of times you have tamped explosive cartridges with a pole or bumper and "got by with it," but regardless of the supposed success of your past practice, you are still wrong if you want to be safe. It is better to gain explosive efficiency by bringing the cartridge diameter and the diameter of the bore hole closer to each other—and then be satisfied with the result and with an uninjured body.

Having the exact amount of explosives needed adjacent to each hole scatter the boxes over the shot where they are handy when needed as the loading progresses. This same scattering of the boxes divides the hazard of amount in one place to sparks, lightning and misfires. Sometimes it is necessary to break cartridges to smaller pieces to load obstructed holes. Remember that as such a hole is loaded the hole walls become somewhat coated with adhering explosive. It is wise not to tamp even the stemming in such a hole. After the explosives are loaded in a hole throw in at once enough stemming to protect the exposed explosive from any fire. Look well to the kind of stemming or tamping used. In most quarries the finer size rock dust is used for this purpose. It serves very well, but keep the dust free from larger size rocks that might cut the fuse, wires, or cordeau while being tamped on the explosive charge.

We are all prone to give a sigh of relief when the last hole of a shot is loaded and tamped, and indeed quite a bit of our blasting hazard is over; but even though the details of your quarry operation press you hard for the stone in this blast take your time while connecting the detonators on the shot and make sure it is rightly done. Use only experienced men to "hook up" the shot. Make a final inspection of all connections after the men, with their sometimes blundering feet, have been sent away. A poor connection of the

detonators means a missed hole, and a missed hole not only means a poorer shot but passes a hazard to the shovel crew who have no good way to protect themselves. When you are finally ready to make the blast, take the further step of assuring yourself that men and equipment are in the clear. See that they are even more than sufficiently safe, for a blast will sometimes fool even the best "guesser" on the job as to where it will land. Make sure, by instruction and practice, that your men, especially the new ones, recognize whatever type of blast warning signal you use. It goes almost without saying that you will take steps to protect nearby transportation highways and residents from possible flying stone from the blast.

If you shoot with electricity do not connect the shot with the power line or battery until the main switch and fuses are pulled. In damp conditions, where there is a possibility of a ground through the switch block, go even so far as to disconnect the wires leading from the switch or battery to the shot until everything is ready to make the blast. It is a good practice to have a man stationed constantly by and in charge of the battering or firing switch from the time the detonators are being connected until the blast is made. If the shot is fired with a fuse and cap it is well to make a second, or "dummy" fuse and cap six inches shorter than the main shot fuse. Light this "dummy" first when lighting the shot fuse and on its exploding the cap you will know within fifteen or twenty seconds when to expect the blast to go. If the powder fuse has been kept dry and is not kinked it will follow the manufacturer's rate of burning very closely, but no dependence should be put on a fuse in poor condition. In case of doubt about a fuse, that has been lighted and does not explode the cap in reasonable time for its length, wait at least an hour before approaching it to discover the cause. Some very peculiar things have happened with poor fuse. Having successfully accomplished the loading and firing of a bank blast, do not be hasty in returning into the fumes and smoke that nearly always surrounds the blasted rock. Be sure to wait in damp weather.

The same general sense applies to secondary, or pop, blasting as has been said about the b a n k blast. Have a couple of small storage magazines in the quarry handy to the work, one for explosives, and one for detonators. Pick out a steady reliable man for this work. After all is said and done, safety or hazard goes as the man goes. Beware of the fellow who carries explosives or caps around the shovel or locomotive in an open box, or who carries caps or explosives or both in his pockets, or who crimps caps on fuse with his teeth or a knife, or who wants to save you money by using short length fuses, or who takes pride in the large number of fuses he can light at one time and get away with it. The practice of lighting a "dummy" fuse shorter than any used in the small hole shots, lighted first, and used as a warning signal to get under cover, is a good way to avoid trouble with this part of blasting.

In closing I offer this word to you men who are executives in quarry operations—none of these suggested safe practices about blasting, and the use of explosives, will cost you very much money. Compensation for the injured and killed calls for a good sized check. An informed, reliable, man is needed for supervision every time major blasting is done in a quarry if safety is to be a companion with your blasting. Let such a man have your confidence. Educate him constantly that he in turn may educate the men who must handle and use explosives in your quarry that they may come contented to work in the morning and go home safe and happy at night.

"A laugh is worth a hundred groans in any market."

Cement from Russia

Announcement has been made by the Treasury Department to the effect that cement from Russia will hereafter be admitted into the United States free of duty under reciprocal provision of the cement paragraph of the present tariff act.

Some time ago the Soviet of People's Commissars issued a decree authorizing the Soviet customs authorities to admit cement free of duty into Russia when from a country which imposes no duty upon Russian product. A similar provision is contained in paragraph 1543 of the tariff act of 1922, and free entry privileges will be accorded to cement both in the United States and in Russia.

Hazards of Standard and Narrow Gauge Railroad Equipment in Quarries

By W. W. Stewart of Koppel Industrial Car and Equipment Company*

RAILWAY equipment and its operation confronts us with hazards requiring much prudence and care to overcome, and our efforts toward safety lead us to thorough investigations of the factors—cause, effect and remedy. We know the cause is primarily carelessness and neglect, and we know that the effect is sometimes appalling but the remedy we must work out to our own satisfaction.

Standard gauge railroads, as well as most of the industrials, have been relentless in their crusade against accidents by educating their employees, as well as the public, to their ideals of safety. Statistics will show that their efforts have been highly rewarded.

For operation of equipment, the standard gauge railroads have their standard rules and regulations to govern application of safety appliances for interchange, but for the industrials, or narrow gauge railways, it is practically impossible to establish one set of standards applicable to all industries, as each industry has conditions peculiar to its particular line of work.

In the quarries we encounter extreme hazards. We are obliged to combat such elements as very poor track conditions with heavy grades and inclines, overloading of cars, improper loading of cars, excessive spotting of cars, handling of cars having high center of gravity necessary to insure proper dumping and the use of the link and pin couplers.

In reference to track conditions, the standard gauge railroad equipment requires the use of heavy rails; and as the cars have double trucks, they will ride very uneven tracks. As the narrow gauge equipment requires lighter rails and smaller cars with single truck construction, considerable difficulty is experienced in keeping cars on the track. To maintain perfect road bed would require considerable expenditure because just as soon as the steam shovel has made one cut, it is necessary to move this track over to the face of the quarry. However, it is true that the high and low spots, loose joints, crooked rails, proper elevation on curves and widening of track gauge at the curves should be taken care of in the quarry, thereby reducing to a minimum the possibility of derailments and wrecks.

A very common practice in quarry work is the overloading of cars and loading of cars heavily on one side to facilitate dumping. Both practices are detrimental to safety. The ideal quarry car to withstand heavy quarry service must have body construction to stand abuse occasioned by dropping of large rocks from the steam shovel dipper and must have stability of frame required for handling cars in trains, yet sufficient flexibility to insure satisfactory operation on uneven tracks. Where side dump cars are used, the design requires a very high center of gravity to secure proper dumping angle. When such cars are in transit the unevenness of track causes considerable swaying of the cars, resulting in spilling of the load, subsequent derailment, and ultimately, loss of production to the manufacturer, property damage to tracks and cars and possible chance of injury to workmen.

One of the greatest hazards of railway equipment in quarries is the use of the link and pin couplers. On standard gauge equipment the automatic coupler is used almost universally. The larger equipment generally operates on heavy rails and large radius curves, whereas, the narrow gauge equipment must operate on light rails and very small curves. The automatic coupler is limited to a certain extent in its ability to function properly and still take care of the vertical and lateral motion due to unevenness and curvature of track, but the link and pin coupler permits wide clearances and will function under very adverse conditions. The coupling of cars requires adjusting the link into proper position when cars come together, and this operation sometimes results in injury to workmen. The coupler, in addition to being the means of coupling cars

*A paper presented on September 30, 1925, before the joint meeting of the Cement and Quarry Section at the National Safety Congress held in Cleveland

together, is also part of the drawbar and is subject to severe shocks and strains. Also the hauling of cars on inclines with cable hooked into the coupler and "spotting" of cars, requiring considerable jerking of trains both work hardship on the couplers and draft gear.

The general practice on draft gear with automatic couplers is to use a lipped yoke at the coupler. On small narrow gauge cars a yoke cannot always be used, so the split tail coupler is substituted. This split tail coupler requires the use of a pin at the end of the coupler shank and this pin is not always accessible; therefore, on cars with this type of coupler the draft gear should be subject to periodical inspection and frequent replacement of this particular pin.

Another small detail which if given proper attention will eliminate considerable hazard, is the oiling of the journal boxes. Most quarry men believe that the oil should be inside the journal box, and this is correct; but—why not put a little oil on the outside of the box where the box rubs the pedestals? This would insure free movement of the boxes in the pedestal guides when the springs are compressed; and if proper clearance has been provided between the bottom of the box and the pedestal tie bar, the wheels will ride the high and low spots in the tracks reducing to a minimum the possibility of the flanges of the wheels climbing over the heads of the rails causing derailment and possible injury to workmen.

Here is a case where on a certain day a quarry car jumped the track on a sharp curve. The foreman instructed a track worker to jack the track at this particular place while he, the foreman, went to the quarry supply house to secure some new spikes. The quarry foreman failed to inform the locomotive engineer that work was being done on this curve, and he also failed to place any warning sign, such as red flag, or otherwise to show that work was being done. Before he returned from the supply house with the spikes, the locomotive pushing a train of empty cars ahead of it on its way back to the steam shovel, ran over and killed the track worker.

Where the stone is being conveyed from the quarry up an incline to the crusher, you will find at the foot of the incline two tracks, one on which the loads are pushed in and the other track for the empties to be lowered from the mill. On a certain day an employer was short one man, and this man happened to be the regular cable hooker. The quarry locomotive was pushing in a train load of stone from the steam shovel just when the cable hooker was in the act of hooking to a car and actually pushed against this man. This accident resulted in a permanent and total disability claim. This particular employer has been paying compensation to the injured man for a period of two years, and from all indications, will continue doing so for the life of this man.

An accident that seems to be quite common in some of the quarries occurs when the hoist man releases the empty car down the incline and it bumps into other empties at the foot of the incline just when one of the employees is coupling up the empty. The man coupling up should use a hook for guiding the link into the coupler, and the hoist man should be careful in dropping the cars down the incline and not allow them to run down so far on the empty track as to bump into the cars at rest.

When loading material from the bins into the railroad cars, it is customary to have the track elevated, and on this elevated track the railroad company spots the empty cars. Occasionally an employee will drop an empty car down to the bins without first examining the brakes, and this car will get away crashing into another car that has been loaded, thereby causing a wreck, sometimes a derailment with loss of time and frequently an injury to an employee. It appears that proper instructions by the superintendent to the employee, to properly inspect this equipment would prevent such accidents.

There is another hazard relative to the railroad company's equipment which frequently causes trouble. Considerable equipment is placed at the industry's loading track not properly cleaned out, and it is necessary for the loader to have one of their employees clean these cars. To do this it is necessary to drop the hopper. A great many stone producers are using the old style hopper wrench, and if they would use what is known as a safety hopper wrench, a good many accidents could be prevented.

Take the case of a certain stone

plant in Ohio where they received a carload of coal in a hopper, and the employee was sent to dump this carload of coal on the coal dump using the old type wrench. There is a certain amount of tension on the locks of the hopper, and when released the wrench flew around, striking the man and causing injury. With the right kind of equipment to open this hopper this accident could never have occurred.

At some quarries considerable stone is being moved by motor trucks, and in many cases it is necessary for these trucks to drive under the bins where the railroad cars are loaded and where the dinky locomotive travels back and forth moving this railroad equipment. In those particular cases the operators should use extreme caution to prevent damage to the trucks or injury to the driver. Here is a case where a car being spotted for loading got away and crashed into a truck while being loaded underneath the bins. In the truck driver's endeavor to get away he was pinned between the truck and the railroad car and killed. With a little more care this accident could have been prevented.

Most accidents are preventable, and generally your investigating committee will report that had proper precaution been taken the accident could have been averted. To overcome or even minimize, the hazards of operating railway equipment in quarries it would seem that the most feasible plan would be the selection of competent employees for this class of work; proper caution instruction with strict rules; enforcement of the rules; use of conspicuous warning signs; periodical inspection of equipment and frequent inspection of reciprocating parts to detect sharp flanges on wheels, worn or defective parts, thereby, protecting our fellow men and more nearly conducting an operation of safety.

Domestic Bulletins

Trench pump units and portable air compressor units as manufactured by the Domestic Engine and Pump Company are described and illustrated in separate bulletins which are ready for distribution.

The various types and sizes of pump units and air compressor units are given with their complete specifications.

Hayward Buckets

Two new bulletins have been issued by the Hayward Company. One of these, bulletin 650, is descriptive of the Hayward class E clam shell bucket; the other, bulletin 655, concerns the Hayward orange peel bucket.

Both buckets are of the power wheel type. In the orange peel bucket the power wheel, in assembly with shaft cams and side chains, forms the closing mechanism. This mechanism, operated by a line attached to and passing around the power wheel, secures powerful leverage in closing on materials when the bucket is digging. In the clam shell bucket the power wheel, with the rope guard frame and patented flat link side or closing chains, is of such design that in addition to the easy working conditions and the proper guarding for the rope, it provides ample leverage or closing power in the bucket for handling loose materials and even for some kinds of excavation.

Both bulletins are neatly printed in convenient pocket size and nicely illustrated.

Cableway Excavation

An interesting catalog has been prepared by the American Manufacturing Company which discusses cable way excavators, excavating buckets and hoists. The catalog which is profusely illustrated discusses the efficiency of slackline excavators, bucket loading and cable way excavating as a field of greater possibilities. Some representative installations of the American system are ilustrated and described.

The Dixie Lime Products Company of Ocala, Florida, has purchased the Florida Lime Company with large deposits at Zuber. This transaction has been effected by J. M. Meffert, principal stockholder in the Florida Lime Company, and is one of the largest transactions which have taken place in the lime industry in Florida.

Victor Wilmot, who has for several years been Chicago district manager of the Dodge Manufacturing Corporation, has been appointed general sales manager of the company. Mr. Wilmot's headquarters will be at Mishawaka, Indiana.

The New Mexican Gypsum Development

By E. D. Roberts

PIONEERING in a way that during the present age is found only in story books has resulted in the development in an efficient manner of an immense deposit of gypsum on the Island of San Marcos in the Gulf of Lower California. After a thorough prospecting of the deposit a company was formed under the laws of Mexico to be known as the Company Occidental Mexicana.

The next step was to make detailed plans for the development of the deposit. This was done, and everything required for construction purposes or in the plant itself was bought and assembled in San Francisco by February 15th of this year. A boat was chartered and the equipment loaded. This boat left San Francisco on March 15th for San Marcos Island carrying everything needed from tooth picks to the large crusher for preliminary breaking of the rock. The carpenters and pile driver crew required for construction work were taken with them while all labor was secured in Mexico at a town called Rosalia, which is about 12 miles from San Marcos and on the mainland.

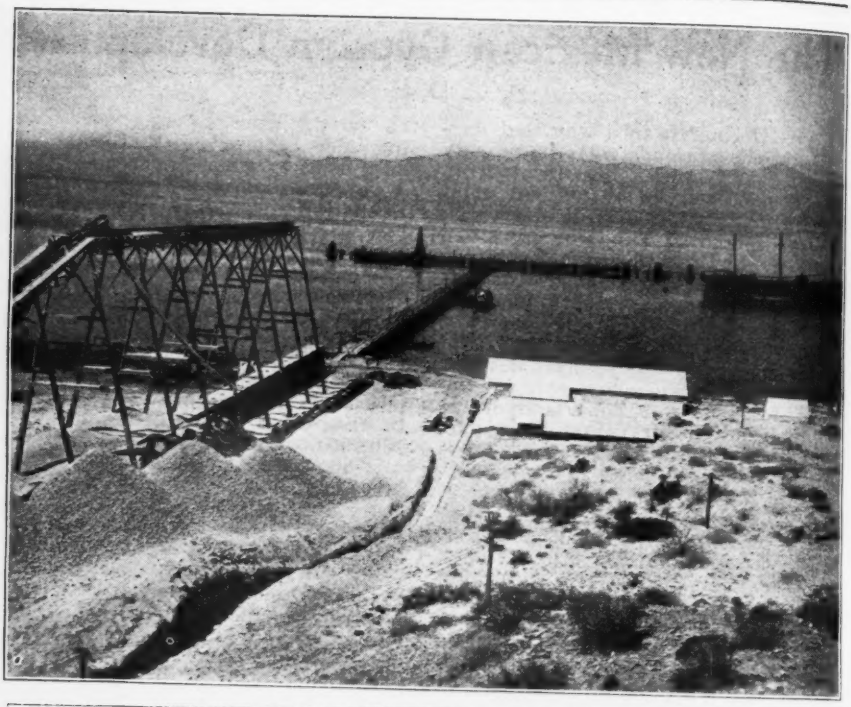
Arriving at San Marcos they found a well sheltered sound between the island and the mainland in which anchor was dropped. All materials and supplies were lightered ashore as no facilities of any sort were available before they arrived. The only living things upon the island were scorpions and rattlesnakes. Even water for drinking purposes had to be brought over from the mainland, a distance of several miles.

Work was actually started on April 15th, and gypsum was being crushed by July 15th, which was quite a feat when the difficulties which they had to surmount are considered.

The gypsum deposit lies in an exposed position roughly 1½ by 2 miles in area containing considerably over 100,000,000 tons. The prospecting was done by Mr. W. E. Hendry and Mr. W. C. Ridell. One hundred representative samples were taken which averaged 97 per cent calcium sulphate, the samples mining from 95 to 99 per cent pure.

Before actual construction was started, housing for the employees had to be put up, and equipment to be used during the construction placed. A 200 H.P. Busch Selzer Diesel engine was installed to generate electric power for construction purposes and to operate the quarry and shipping facilities during operation. Tunnels were driven to develop the deposit tapping it 100 feet below the surface. Raises inclined at 45 degrees are put in about every 200 feet with gates constructed at their junc-

View of Deposit Showing Character of Country

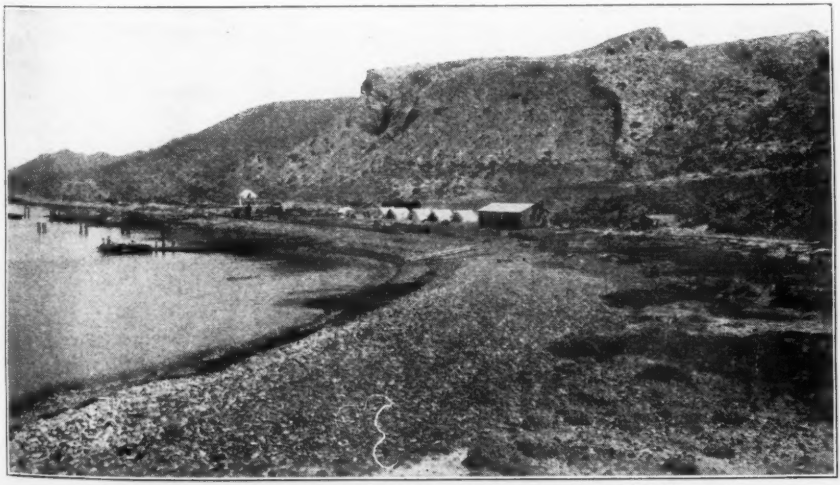


Top—The Storage and Dock. Bottom—The Trestle Bins and Crusher Feed

View Showing Loading and Storage System

tion with the tunnel. A bulldozing chamber is constructed above the gate to the tunnel. Large boulders are broken up in this chamber by Ingersoll Rand paving breakers which save a great deal of time which would be lost waiting for shots. The shaft is kept filled to the floor of the chamber to facilitate breaking up the boulders. Three glory holes are being operated at present producing about 300 tons of rock for each hole per day.

Sliding gates allow the rock to fall into 3 yard Easton rocker dump cars which are hauled to the primary breaker by 2 4-ton Plymouth locomotives. These cars dump directly into a bin. A feeder causes the rock to fall from the bin onto an inclined grizzly which allows the fine material to fall directly onto a 16 inch inclined belt which operates under the crusher and carries the crusher output to the stock pile. The coarser rocks fall into a 44 inch Ehrsam Jaw crusher which reduces the material to 4 inch maximum size. As stated before the crusher discharges onto a 16 inch inclined belt which carries the crushed rock to the top of the distribution trestle. A traveling tripper discharges the rock to the storage pile below. The trestle is 72 feet high



View Taken April 15, 1925, Before Any Work on Plant Had Started

and 270 feet long, composed of 10 bents with a span of 30 feet between each bent. The stock pile holds about 70,000 tons, 40,000 of which is what is called live storage.

A tunnel 7 feet in cross section is constructed directly under the trestle. Thirty openings in the top of this tunnel are provided for reclaiming the material from the stock pile. A Bodinson pan feeder traveling on a 36 inch gauge track draws the material from the pile and discharges onto the 36 inch shipping belt which operates in the tunnel and carries the rock towards the dock. Two belts with 700 foot centers each are required to do this; the first discharging onto the second which discharges onto two 24 inch belts operating in both directions from the 36 inch belt at right angles to it and along the face of the dock on a trestle. Two traveling trippers with spouts, one on each 24 inch belt, chute the rock into two holds of the ship at a time.

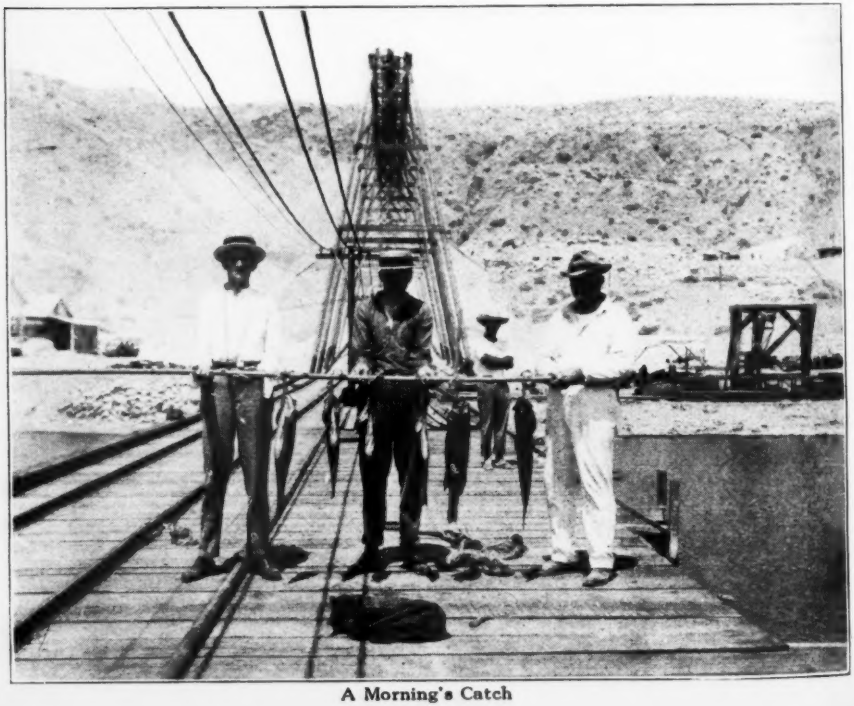
A Merrick weightometer is placed so that all material which passes over the second 36 inch belt is weighed. This is necessary as an accounting must be made to the Mexican Government for all gypsum exported.

Each of the long 36 inch belts is operated by a 75 H.P. General Electric motor. The crusher and the Ingersoll Rand compressor are likewise operated by 75 H.P. General Electric motors. This provision allows for using either or both of the other two 75 H.P. motors in case of trouble with those operating the shipping belts while loading a boat.

The belt from the crusher to the stock pile is operated by a 25 H.P. motor, while each 24 inch belt along the face of the dock has a 15 H.P. motor. The conveying equipment was furnished by the Bodinson Manufacturing Company of San Francisco.

A dock extending 1000 feet out into the channel was constructed on piling. At the end of this a wharf 80 feet wide and 420 feet long was constructed at right angles to the dock with half on each side. Two large dolphins were placed in line with each end of the wharf to facilitate the berthing of ships. The water is 40 feet deep at low tide along the face of the wharf.

Mr. W. E. Hendry was in charge of construction and will continue in charge until everything is going smoothly when Mr. E. D. Moiles will take charge and operate the plant.



A Morning's Catch

By E. D. Roberts

CATALINA rock is produced on Catalina Island by Graham Brothers Incorporated from one of the largest and most completely equipped side hill crushed stone plants in the country. The crushed stone produced is among the finest in quality, and it has been used in practically every building of any size erected in Long Beach. The rock averages 2.65 specific gravity and is tough, losing only about 12 per cent in the standard rattler test.

Catalina Island is situated off the southwestern part of the United States. This island is about thirty miles from the mainland of California and is south of the ports of San Pedro and Long Beach. Tourists and pleasure seekers visit this island to enjoy big game fishing and to see the ocean floor through glass bottomed boats. William Wrigley purchased the island and in the fall of 1923 gave the Graham Brothers Incorporated a lease which permitted them to erect a crushed stone plant. A remarkable side hill crushed stone plant was erected and placed in operation in January of 1924. This plant has been in operation ever since and now stands as an example of engineering skill with a proven record. At the present time 30,000 tons of crushed stone are produced per month. The plant has approximately 100 employees at the present time.

The quarry floor was located at a point 260 feet above sea level. This was done so that gravity could be utilized without the expense of building costly trestles. In opening the quarry coyote holes with T shaped ends were driven and loaded with about 20 tons of Hercules powder for the initial shot. Nearly 100,000 tons of rock were produced in this way. The plans being developed will give a quarry face for about a half mile around the contour of the hill with a working face of over 100 feet in height.

A 35 ton Marion steam shovel operating on a standard gauge track loads the rock into 8 yard Western side dump cars. These cars are then hauled by a Plymouth gasoline locomotive to the Traylor primary jaw crusher. The cars are dumped automatically by a steel bail engaging the side of the car and being lifted by a single drum hoist. A car may be dumped entirely or gradually by controlling the single drum hoist.

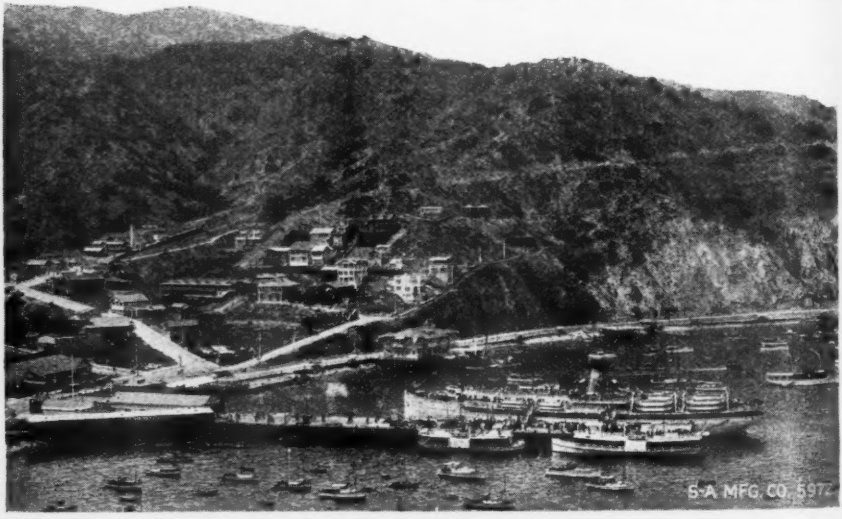
The rock is dumped from the cars directly into the 60 inch Traylor jaw crusher which is operated at 120 R.P.M. by a 200 H.P. Fairbanks Morse ball bearing motor through a 20 inch belt and an American system of rope drive. The rope used is 1¼ inches in diameter with a graphite core.

The discharge from the Traylor crusher which is 8 inches and less falls by gravity into a storage hopper which was blasted out of the side hill rock. Here 1000 cubic yards of rock can be stored in case of trouble with the quarry or when the shovels are shut down during blasting or other quarry work. The material is fed from this hopper by a Stephens Adamson apron feeder to a 36 inch 75 foot centers Stephens Adamson belt conveyor which discharges to a 60 inch 18 foot Stephens Adamson

A Distant View of the Catalina Island Crushed Stone Plant of Graham Brothers, Inc.

heavy duty trunnion type screen which is equipped with manganese steel plates of 3½ inch perforations and an 8 by 8 foot dust jacket with 1 inch perforations. The screen has a separate 20 H.P. ball bearing slip ring motor drive.

The apron feeder is a 42 inches wide by 12 foot centers roller track, and by traveling it at 10 F.P.M. a regular and even feed is maintained. This is necessary for the most efficient screening. The belt conveyor and the apron feeder are operated by a single drive from a 15 H.P. ball



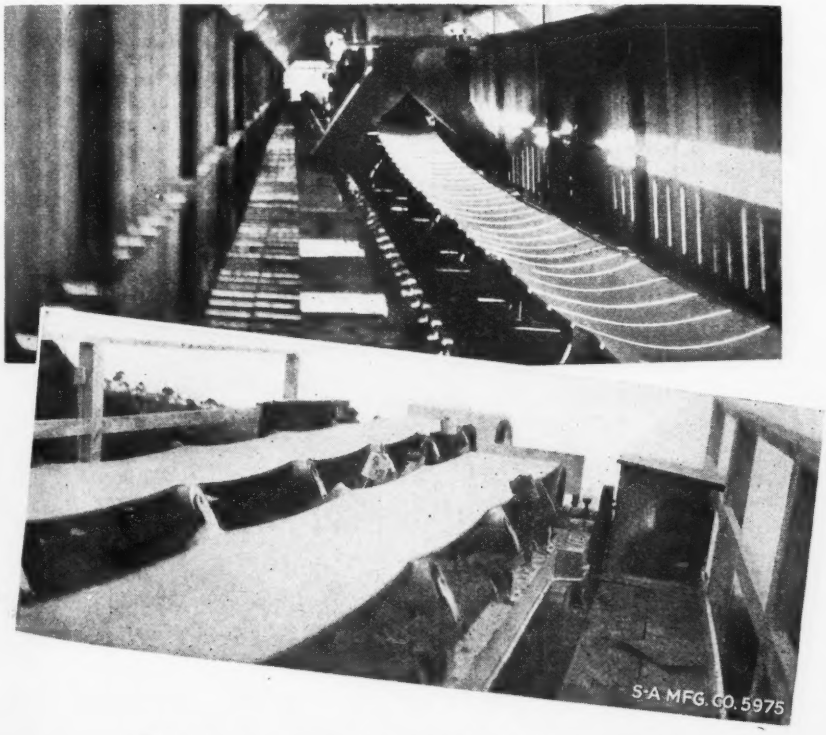
View of Avalon on Santa Catalina Island

bearing motor.

The scalping screen makes three separations, namely; 3½ and over; 3½ down to 1 inch and 1 inch and under. The rejects fall directly into a bin while the other two sizes fall into separate hoppers which feed a 24 inch 70 foot centers Stephens Adamson belt conveyor which delivers the material to storage. One of these belt conveyors takes the material which passes the 3½ inch opening but which is retained on the 1 inch openings to storage or to a number 4 Telsmith reduction crusher as desired. Each conveyor is operated by a direct connected Fairbanks Morse 5 H.P. ball bearing squirrel cage induction motor.

The rejects from the scalping screen are fed by gravity into a number 16 Telsmith gyratory crusher which reduces the rock to 2½ inches and less. This crusher is belt driven by a 75 H.P. Fairbanks Morse ball bearing slip ring motor and produces 130 tons per hour at 275 R.P.M. The discharge from this crusher falls directly into a Stephens Adamson secondary trunnion type scalping screen 48 inch by 16 feet with 2 inch perforations. A 15 H.P. Fairbanks Morse ball bearing squirrel cage motor operates the screen. The screen discharges into a two compartment reinforced concrete bin of 1000 cubic yards capacity. One of these compartments is for material under 2 inches and the other for the oversize from this screen and also for that rock which passes the 60 inch Traylor crusher.

The stone from the bin holding the larger size is drawn off onto a 24 inch 60 foot centers Stephens Adamson belt conveyor which discharges into two number 4 Telsmith gyratory reduction crushers set at 1¼ inches. Each of these crushers has a capacity of 60 yards per hour at 325 R.P.M., and they are driven by 60 H.P. Fairbanks Morse ball bearing slip ring motors. The material from the smaller bin is drawn off onto two 24 inch 60 foot Stephens Adamson belt conveyors which discharge di-



Belt Conveyors Equipped with Unit Ball Bearing Carriers

rectly into the final sizing screens. These last two conveyors operate on the same center line as the crushers, and as they pass under them they take their discharge. It is seen that it is not necessary to operate the last two crushers if there is enough material in the bin which has passed through the second screen.

Final sizing is made by two 48 inch by 18 foot Stephens Adamson number 9 trunnion type revolving screens operating at about 14 R.P.M. The first 8 feet of the screen is perforated to pass 1½ inch rock and the rest is perforated for 1 inch rock. A dust jacket 72 inches in diameter by 8 feet long with ¼ inch perforations is placed around the upper end of the screen. These screens give 4 gradations of rock which falls directly into 5 bins below, namely: dust to ¼ inch, ¼ inch to 1½ inch, 1 inch to 1½ inch and over 1½ inch. This five compartment bin has a capacity of 1000 cubic yards of crushed rock. As rapidly as each of these compartments is filled, it is drawn off by a 24 inch conveyor belt operating on 60 foot centers. This belt is located in a tunnel below the bins and receives the rock through 15 by 18 inch cut off gates. This conveyor discharges onto the storage conveyor which is also 24 inches wide and operates on 338 foot centers. The material is elevated about 30 feet above the ground and tripped off the belt to the various storage piles below by a self propelled heavy cast iron Stephens Adamson tripper. This storage pile is 250 feet long, providing storage for about 8000 cubic yards of rock.

A reinforced concrete tunnel has been constructed under this outside storage area. Cut off gates 15 by 18 inches in the top of this tunnel feed the crushed rock to another 24 inch Stephens Adamson conveyor which carries the rock to another storage area near the sea shore. This conveyor operates on 550 foot centers, elevating the material about 30 feet after emerging from the tunnel and then running horizontal for about 150 feet over the secondary storage area. A traveling tripper discharges the rock to the various piles. 4000 cubic yards may be stored here. This storage area brings the capacity after the mill up to 12,000 cubic yards. The plant produces 1000 cubic yards of crushed rock in an 8 hour shift without crowding.

As the rock is used on the mainland, some means of loading boats or barges had to be provided. This was done as follows. A reinforced concrete tunnel was constructed under the last named storage pile with 15 by 18 inch cut off gates to feed the crushed rock to a 36 inch belt. This belt is 310 feet long and extends out over the water on a pier. Traveling at a speed of about 400 feet per minute, it has a capacity of about 800 tons of rock per hour. At right angles to the 36 inch reclamation conveyor a cantilever bridge has been constructed supporting a 36 inch by 50 foot conveyor which receives the discharge from the reclamation conveyor and discharges it to the barge or boat below. This last conveyor has been constructed on a wheeled frame providing for moving so that the rock can be distributed over the whole width of the barge. The barges

The Long Beach Plant Showing the

used hold from 500 to 1000 cubic yards and are easily loaded in one hour. A weighing device in the reclamation line accurately determines the tonnage on each barge.

The barges are handled to the mainland at Long Beach, San Diego, San Pedro, and Wilmington by the Wilmington Transportation Company under a contract rate.

Electric power for operation of the Catalina crushing plant is supplied by the Santa Catalina Island Company from its central power plant at Avalon. The power company generates the power by Fairbanks Morse type Y oil engine direct connected to 2300 volt alternators. This 3 phase, 2300 volt 60 cycle electricity is stepped down to 440 volts at the crushing plant. Provision for caring for the entire connected load of 600 H.P. has been provided.

Fairbanks Morse ball bearing motors have been used throughout the plant. Sizes of motors have been standardized so that fewer spare parts will require stocking for quick repairs. The ball bearing type of motor is of the self aligning dust proof type which has found favor wherever corrosive dust is encountered.

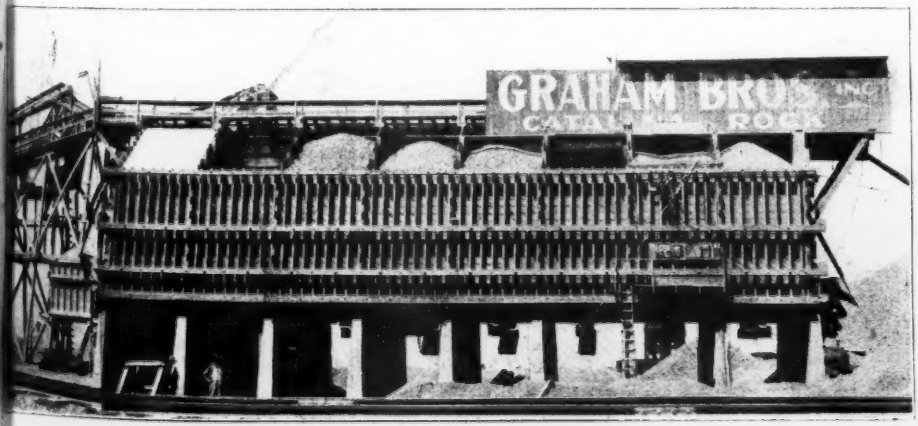
The construction of this plant was done by Graham Brothers Incorporated, and the engineering services on the installation were rendered by the Stephens Adamson Manufacturing Company. This latter company also supplied the ball bearing unit type conveyor rolls, trippers, cut off gates, screens and gear transmission. Unloading and distributing plants are maintained at San Pedro, Wilmington, San Diego and Long Beach. The Long Beach plant is the largest and will serve in our study of the movement of Catalina Rock from the quarry to the job.

The Long Beach Plant

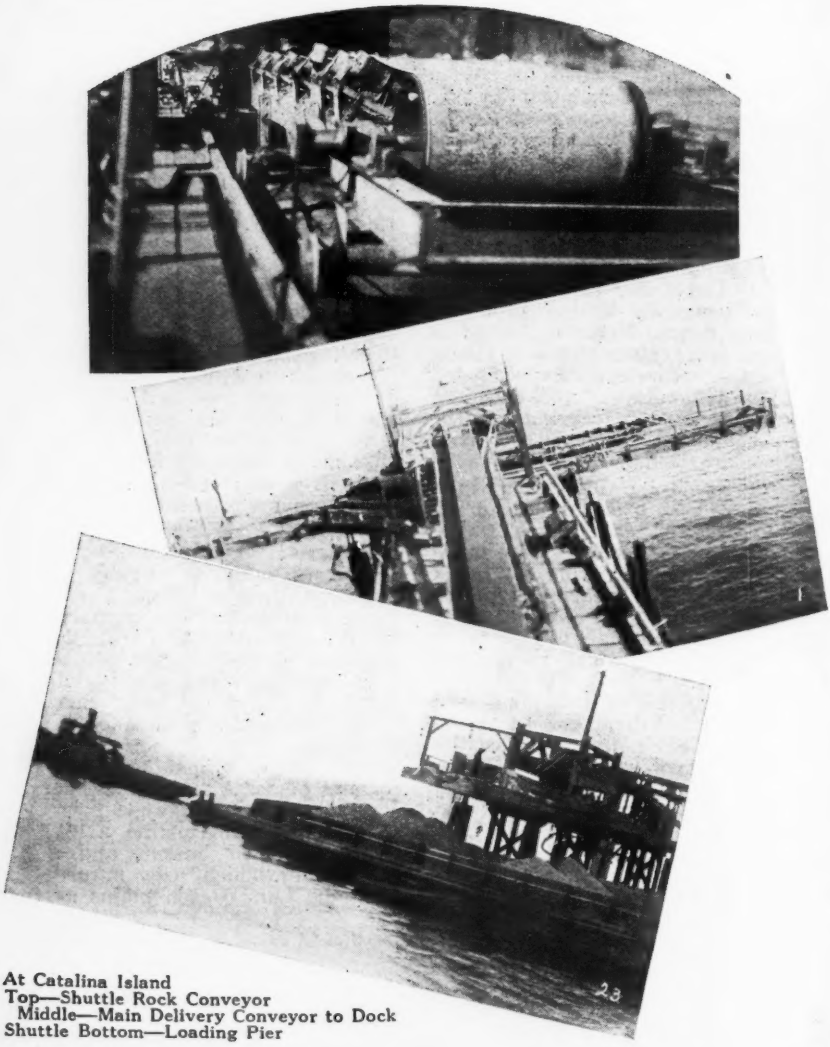
The Long Beach plant of Graham Bros. Incorporated, is the main distributing plant of Graham Brothers Incorporated. Long Beach was chosen for several reasons. It has a good harbor with considerable water frontage. This harbor is now being improved and when completed it will make Long Beach one of the important shipping centers on the Pacific Coast. Long Beach is a rapidly growing city with an estimated population at the present time of 150,000. Long Beach is also an industrial center with excellent railroad facilities and with many improved highways which make it a strategic position from a distribution viewpoint.

The unloading and storage plant built here is a very efficient means of delivering material rapidly to any harbor project or to any local or interior operation. The prepared material comes from the Catalina Island plant on barges of from 500 to 1000 tons capacity which are towed from Catalina Island to Long Beach by tugs. This haul is a distance of about 30 miles.

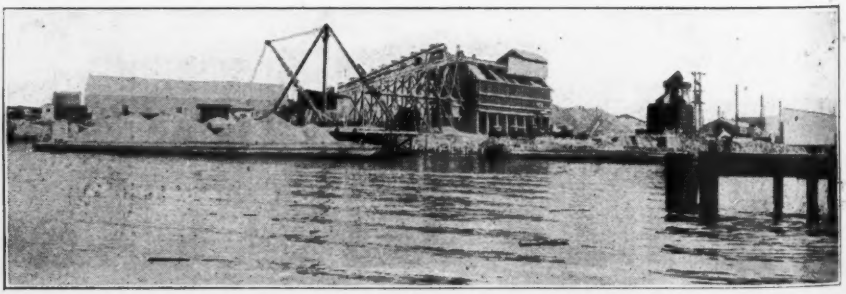
The large unloading equipment consists of an A frame steel derrick, a triple drum Lidgerwood hoist with an extra swinging engine, a 1½ yard Owen clamshell bucket, and a 125 H.P. boiler which uses natural gas from the Long Beach mains as fuel.



Unloading Dock. Conveyor System and Storage Bins



At Catalina Island
Top—Shuttle Rock Conveyor
Middle—Main Delivery Conveyor to Dock
Shuttle Bottom—Loading Pier

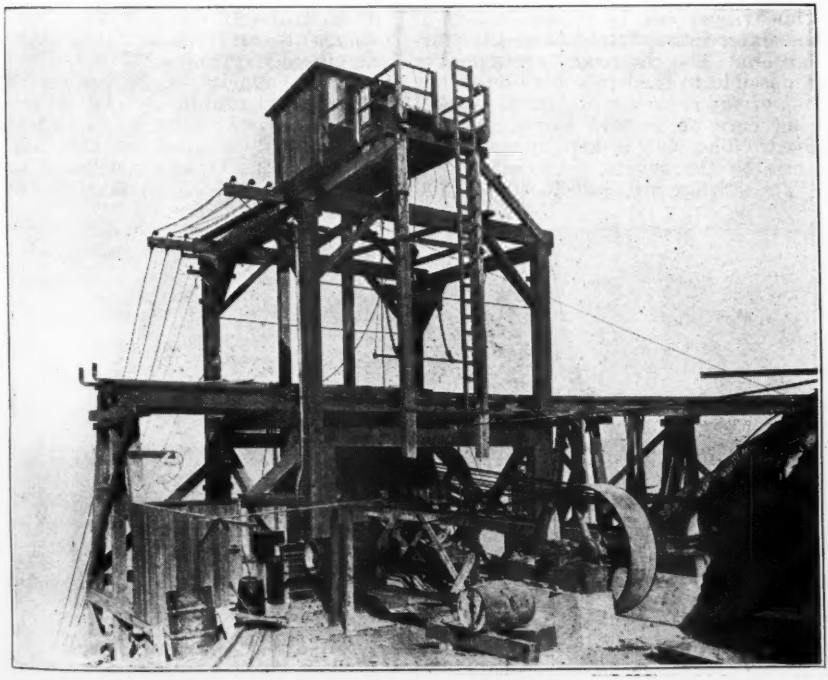


The Long Beach Plant Showing Harbor Facilities

This boiler also supplies steam for operating a Fairbanks Morse piston pump that supplies the plant water and serves as a protection in case of fire.

The Lidgerwood triple drum hoist unloads the crushed rock from the barges and drops it into a hopper of 20 yards capacity. This hopper feeds a 24 inch Stephens Adamson belt conveyor which delivers the rock to the end of a 3000 ton bunker where it discharges the stone to a vibrating inclined screen which removes the dust. The hopper has an adjustable cut off gate for controlling the feed to the belt conveyor. The belt conveyor is 330 feet centers and has an inclined section about 250 feet long and a horizontal head section about 100 feet long. The conveyor rises a vertical distance of 40 feet. The belt conveyor is equipped with Stephens Adamson standard unit ball bearing carriers. The drive for this conveyor is a standard Stephens Adamson tandem drive located on the return belt and about 75 feet from the head end of the conveyor. It is direct connected to a 30 H.P. 900 R.P.M. Fairbanks Morse dustproof ball bearing electric motor. A Stephens Adamson gravity take-up is located directly behind the tandem drive to compensate for an elongation in the belt. This unloading system is simple and reduces to a minimum the operating cost. The ball bearing carriers of unit construction keep the maintenance costs down. They require lubrication only about twice a year but a casual inspection is given about once a month. The ball bearings are in dust proof chambers and because of their low coefficient of friction are savers of considerable power.

The dust falls from the vibrating screen into a hopper from which it is drawn off and loaded into trucks and sold for use in black top paving. The material passing over the screen falls onto another Stephens Adamson 24 inch ball bearing belt conveyor which runs the length of the storage bins and extends on past the bins in case discharge to outside storage is necessary because the bins are full. The belt is a Stephens Adamson special 6 ply with a ⅛ inch rubber covering on the loading side. The material is unloaded from this belt to the bins by means of a Stephens Adamson self propelling, self reversible tripper which is complete with a



Initial Discharge for Quarry Cars at Graham Brothers Catalina Island Plant

Detail of Trestle Support for Conveyor to Bins at Long Beach

three way spout and revolving brush. This tripper can be moved to any of the sixteen compartments of the storage bin. The three way spout makes it possible to load into bins on either side of the conveyor or unload to railroad cars or ground storage as desired. The belt is kept clean at all times by the brush.

The storage bin is 30 feet wide, 100 feet long and 20 feet deep. It is divided into 16 compartments, two of which are covered for the storage of decomposed granite. The bin has a storage capacity of 3000 tons. The decomposed granite is used for driveways and is brought to the plant by barge and unloaded by the Lidgerwood hoist. It is dusty so a cover has been provided to keep the dust

The Unloading Dock at Long Beach

from getting into the crushed rock. A Garden City dust collector is being installed at the vibrating screen to further keep the crushed rock free from dust and to insure a clean product.

The crushed rock may be drawn from the bunkers into trucks underneath or into railroad cars on tracks alongside of the bins. Several of the gates under the bins are provided with adjustable batchers for the measuring of proportioned aggregate. These batchers are of their own design and require very little work for quick changes in the size of each batch.

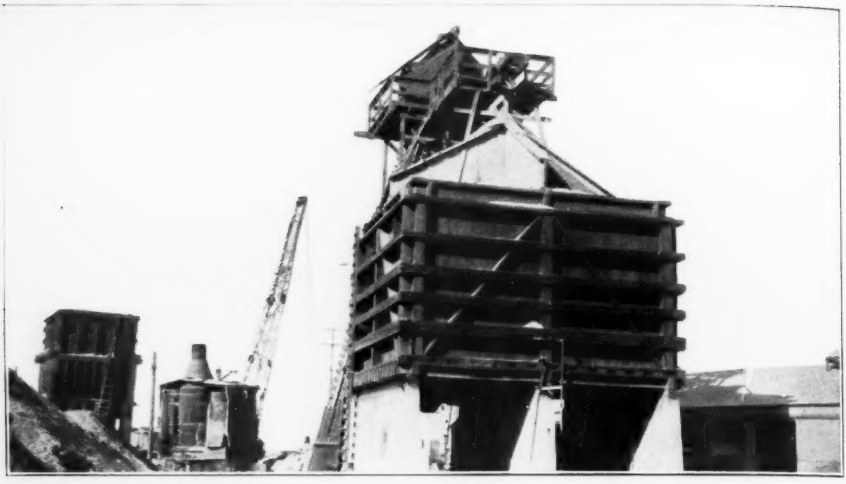
The crushed rock that is discharged over the end of the bins for ground storage is handled to storage and reclaimed by an Orten Steinberner 18-ton locomotive crane operating on the railroad tracks. A 10-ton Byers caterpiller steam shovel aids in reclaiming from ground storage. It handles the crushed rock in a clam shell bucket into a portable hoppered bin. Trucks are driven under this bin and given their full load at once without delay and spill.

There is considerable demand for sand for construction purposes and as there is a considerable demand for proportioned aggregate it is brought in and stored here. The sand is secured from Harbor City or from 10 miles west in the Paulos Verde Hills by auto trucks or railroad. Arriving at the bunkers, it is bottom dumped from railroad cars into a track hopper and elevated by an inclined bucket elevator and discharged into a four compartment sand bin. This bin is also provided with batchers for ready proportioned aggregate. If the sand arrives in trucks it is generally dumped onto ground storage to be picked up by either of the two cranes and dumped into the portable loading hopper into the hopper of the bucket elevator.

A fleet of fifty trucks distributes the crushed rock and sand to the consumers. Thirty of these trucks are the property of Graham Brothers Incorporated, while the other twenty are operating under a contract. After loading the trucks are driven over a Fairbanks Morse 20 ton Type Y scale where the load is weighed by the weighmaster and a ticket handed to the driver. This ticket is in triplicate, one of which goes to the consignee, one to be signed by the consignee and returned to the office by the trucker and one for the trucker. Rock and sand in this section of the country are sold by the ton instead of the cubic yard as this method of payment has been found much satisfactory than that of cubical measurements.

The operations of Graham Brothers Incorporated are a model for effici-

The Storage Bins and Yard Storage at Long Beach



End View of the Storage and Distributing Plant at Long Beach

ency in simplicity, flexibility and low operating costs. Standardization is evident as all motors are of Fairbanks Morse manufacture while all the screening and conveying equipment is of Stephens Adamson manufacture. All drives are interchangeable. The plant is as nearly perfectly balanced as can be attained. The storage units provide adequate protection against any normal shortage of supply due to shutdown. All material is moved by gravity and belt conveyor either in a downward or forward direction. The plant is indeed a credit to the crushed stone industry.

The officers of the Graham Brothers Incorporated are Robert Graham, President; Paul Graham, Vice President; Phil McCaughan, Secretary; W. M. Payne, Assistant Secretary; and Roy Stull, Auditor. William Wrigley, B. M. Renton, J. N. Stewart, W. M. Cook and W. E. Babb constitute the remaining members of the board of directors.

Territory Surrounding the Graham Brothers Plant on Catalina Island. The Plant Can Be Seen in the Distance

Economies in Lime Manufacture

By F. A. Westbrook

ECONOMIES have been introduced in the manufacture of lime and new lines of business developed by the Mississquoi Lime Company of Highgate Springs, Vermont. The operations of this company and particularly the recent practices adopted are of interest and applicable to many other plants.

On account of the topography of the land it has been impracticable to run a spur from the main line railroad closer than about half a mile from the stone quarry. Thus, as all finished product and numerous supplies must be transported by means of standard gauge freight cars, it was thought best to locate the mill at the end of the spur. The stone from the quarry, which must be loaded onto small dump cars in any event for transportation to the top of the kilns, could be the more easily transported over this distance between quarry and mill as no rehandling is involved and as the tracks could readily be given a grade favoring the loaded cars. This operation was begun something like 35 years ago so that, judging from the above layout, it is evident that even at that early date efficiency received careful consideration.

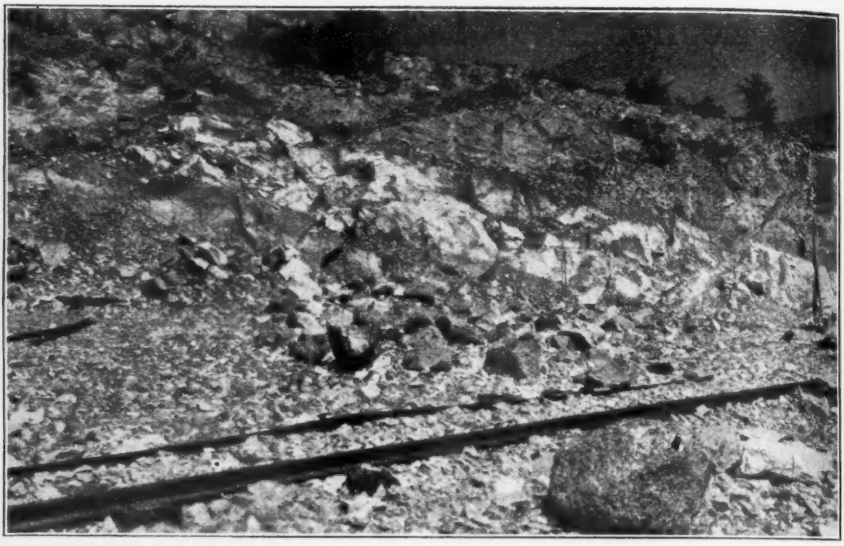
At the present time the quarry covers a considerable area but is not of sufficient depth to require derricks. There are the usual tracks from a number of points at the breast of the quarry which converge into one track leading up an incline to the top. Four ton Koppel side dump cars are used and they are pulled up the incline by means of a Mead-Morrison S-240 hoist. This hoist was formerly operated by steam, now it is operated by compressed air.

Introduction of Economies

It is at this point that we can begin to talk about recent improvements in efficiency. Realizing that economies must be introduced in order to keep on doing business under present conditions the company secured a new quarry foreman who had been in the lime business all his life and who had proved his ability—Mr. P. T. Clary.

One of the new economies was to do away with the use of steam for the hoist and to do it without buying new equipment. There was an Ingersoll Rand 10x10 air compressor, driven by a 35 H.P. General Electric induction motor in operation which was much larger than necessary for present drilling requirements. There was also an unused air tank in an adjacent abandoned quarry, so by simply doing a not very large piping job it was possible to dispense with

Tracks from Point at Breast of Quarry Converging to Incline



Breast of Quarry Showing Streaks of Low Grade Material to Be Avoided

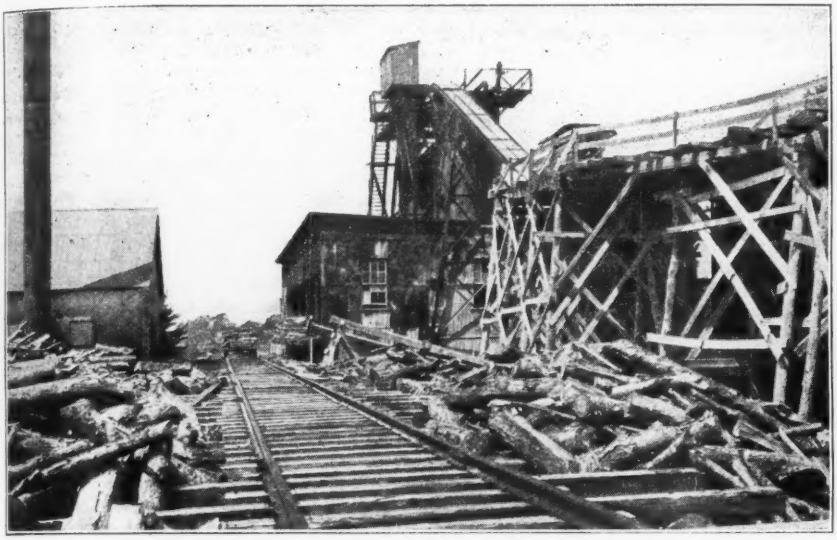
the boiler and the buying of coal. Mr. Clary also found it entirely practicable to operate the hoist himself, no attention to the boiler being necessary. This meant that he could dispense with the engineer-foreman.

Blasting

The next economies which Mr. Clary introduced had to do with blasting. He knew that drilling with the seam increased the production from blasting. By drilling holes 10 feet deep and 8 feet apart in this way he could get 5 feet extra on the break. The drilling is done with 1⅛ inch steel drills and Ingersoll Rand jackhammers.

He also used 40 per cent Trojan powder which is much cheaper than

Small Surface Quarry Adjacent to Kilns Which Is Used in Winter



Keystone Kilns in Background and Old Wooden Kilns in Right Foreground

dynamite if properly managed. This powder comes in paper cartridges. Mr. Clary makes a hole in one end by means of a wooden punch, or awl, for the exploder and covers over the end with hard grease to keep out moisture. He does not wind the wire from the exploder around the cartridge because if it should stick a little in the drill hole the exploder would push out through the grease and permit the entrance of moisture. He simply turns the cartridge with the exploder down and holds on to the wire as each cartridge descends. It is possible to blast wet holes in this way if the charge is set off without much delay.

Side View of Plant Where Finished Product Is Loaded to Freight Cars

Winter Quarrying

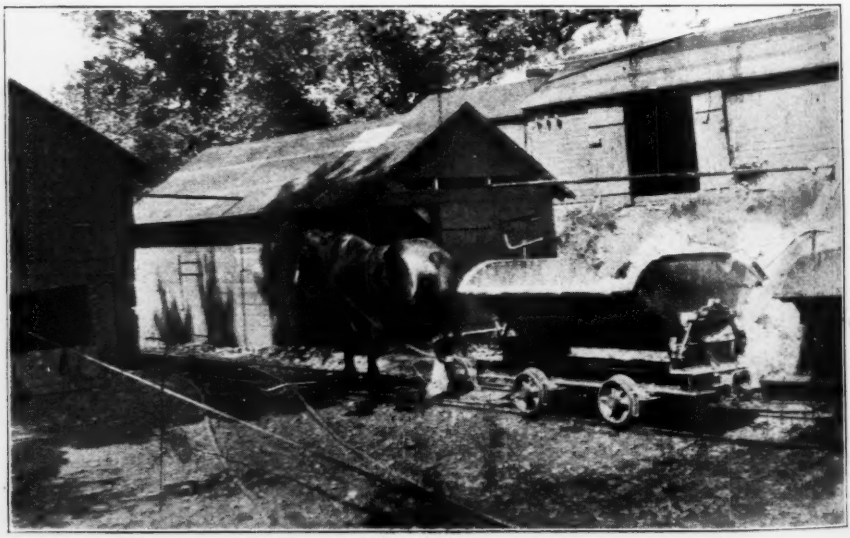
Another means of securing economy is to accumulate a considerable surplus of stone at the kilns during the summer. It has been impracticable to carry this far enough to be able to stop all the quarrying during the winter, but by the exercise of a little ingenuity it is practicable to shut down the main quarry and to operate a small one in the side of a hill very near the kilns instead. The reason why this is economical is because the operation of the main quarry, in addition to calling for the hoist and compressor machinery already mentioned, requires pumping. This latter is done by a belt-driven rotary pump, made by the Centrifugal Pump Company and driven by a 7.5 H.P., 220 volt Westinghouse induction motor; which is satisfactory enough in summer but which requires a good deal of attention in winter to prevent freezing. Furthermore it would be impracticable to operate the hoist by compressed air in winter, and it is a big job to keep the tracks for the dump cars clear of snow. All this would not mean so much in times of large production but is very important in time of retrenchment. There is a small compressor of adequate size at the small quarry in the side of the hill, which takes care of the drilling requirements at that point and makes it possible to shut down the compressor at the main quarry.

By inaugurating all these economies and operating procedures it has been possible to reduce the average cost of stone delivered at the kilns from $1.00 per ton to $0.45 per ton.

Perhaps one of the best things which Mr. Clary has done for his company has been to improve the quality of its product. This, of course, depends as much on the character of stone sent from the quarry to the kiln as on the burning process itself. As will be seen from one of the illustrations, there are seams of magnesia in certain places which had not formerly been properly avoided. That this should have occurred under the unprecedented stress of wartime conditions was obvious but, of course, had to be corrected under the present highly competitive conditions, and this has been done.

Mill

The lime making plant proper, or mill as we shall call it, consists of 2 Keystone kilns and five old fashioned wood burners. In addition to this there is machinery for making plaster and a chalk plant. Stone is dumped into the top of the Keystone kilns from an elevated track and into the old wood burning kilns from a less elevated track because the kilns are not so high. These arrangements are shown in the illustrations. A hoist with a 20 H.P. induction motor is used to pull up the dump cars to the



Horse-Drawn Quarry Car Which Delivers Stone from Quarry to Kiln

top of the Keystone kilns.

Wood is used entirely for the old kilns and in large proportion in the Keystone kilns. It is superior for the making of chalk lime. The use of cord wood is easily possible in this heavily forested region and is brought in on freight cars and delivered by means of chutes directly at the kilns as shown in the illustrations. Of course it is cheaper than coal, and the by-product of wood ash is of considerable value. The only preparation necessary is to sift the ash through a ½ inch mesh screen.

Forced draft is used for all the kilns. It is supplied by two 24 inch Sturtevant fans driven by a 3 H.P. induction motor with a double ended shaft.

All of the lime, shipped as such, is unhydrated, and up to the present time this has formed the bulk of the business carried on by this company. The manufacture of two new products is now being tried out and has just about reached the commercial stage. These are plaster and chalk. This action is a very practical one and the result of an effort at a diversification of output which will tend to obviate to some extent, at least, the curse of periodic depression.

Making Plaster

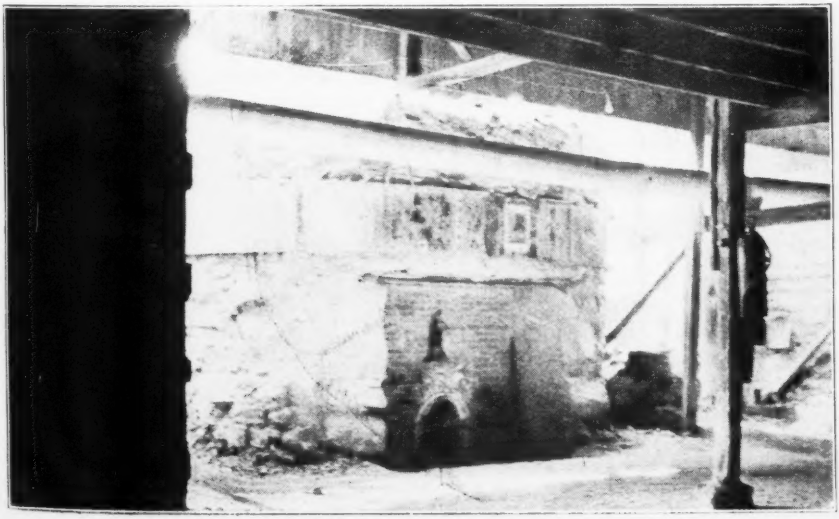
In making plaster the lime, as it comes from the kilns, is shovelled from the floor into a chute through which it passes into a Gardner hammer mill driven by a 20 H. P. motor. This grinds it up and the powder is then carried by means of an elevator to overhead bins whence it is drawn off through a chute by gravity into barrels as plaster.

It is planned to install a conveyor for feeding the hammer mill at an early date, and thus eliminate shovelling.

Chalk

The making of chalk is, of course, a more complicated process. In the first place, as already stated, wood alone is used for burning the stone. The lime is then slaked in a tank with a revolving paddle and the mixture pumped to three decanting tanks so as to remove all grit. One 3 H.P. motor takes care of these two processes.

The decanted liquid is next pumped into the carbonating tanks, of which there are six. The carbonic acid gas, (CO_2), is obtained from the tops of the Keystone kilns by means of a small blower. The impurities in the carbonating tank do not carbonize and settle to the bottom of the tanks. The liquid is then pumped into filter presses which are so arranged that they may be readily pushed into dryers. After the caked material, which is very brittle, is dried, it is placed in a worm conveyor which breaks it up and carries it to an elevator. The latter places it in bins whence it descends through a chute by gravity to the hopper of a Raymond pulveri-



Base of One of the Old Kilns Showing Flue for Forced Draft

zer, and from this it is drawn off into barrels for shipment.

The chalk thus produced is of a very fine grade suitable for use in toilet preparations such as tooth pastes, face powders, etc., and cosmetics. At present there is said to be only one other company in this country which makes chalk, and it seems to be a very practical way of disposing of surplus lime at times when the market for the latter is not what it might be. As a matter of fact it is altogether probable that a business in this material will soon be built up which will go on steadily at all times. As the product is more valuable than lime, this is greatly to be desired.

Handling Materials

The arrangements for handling materials are very complete and are shown in the illustrations. The bringing of stone from the quarry to the mill has already been fully described. Wood and coal for the kilns are brought in over a siding and unloaded on one side of the line of kilns. Another branch of the siding passes along the opposite side of the building where lime is taken from the kilns for loading finished product for shipment.

New Incorporations

Atlas Aluminate Cement Company (Delaware), incorporated for 150[illegible] shares common stock, no par.

Consolidated Sand & Gravel Co., Chicago, dissolved.

Klass Sand & Gravel Co., Cleveland; capital $15,000, Grover Higgins, W. T. Kinder, J. C. Little, W. A. Dougherty, King Tolles, incorporators.

National Sand Company, Pittsburgh; capital $5000; sand, gravel and clay. Incorporators: W. H. McNaugher, Pittsburgh; Ralph D. McKee, Bellevue; George F. Taylor, Jr., Carrick.

Floral Park Sand Co., Floral Park, N. Y. Capital $15,000. F. and A. Weber, J. Wagner, incorporators.

West Side Cement Construction Co., Paterson, N. J. Capital $100,000. Samuel Gubitosa, Louis Antonucci, Little Falls; Jeanette M. Petrie, Paterson, incorporators.

No-Equal Sand and Stone Company, Inc., Reading, Pa. Capital $5000. H. C. Lutz, Wyomissing, treasurer.

M. S. W. Products Co., Trenton, N. J. Capital $125,000. Artificial stone, brick, cement, etc.

W. J. Andrews purchased from Mrs. Amanda Kirkland a gravel pit located on the Donahue Ferry road, eight miles from Alexandria, La.; the property consists of 23 acres. Mr. Andrews will form a stock company to operate it.

Buildings at Top of Quarry

How A U. S. Gypsum Lime Plant Operates With Few Lost Time Accidents

By J. R. Davis, Superintendent U. S. Gypsum Company, Genoa, Ohio*

INDUSTRIAL safety is given very careful attention in all of the twenty-three plants of the United States Gypsum Company. The plant at Genoa comprises a limestone quarry and the largest hydrated lime plant under one roof in the world. This article concerns our accident record at this Genoa plant. I fully realize that many of you are connected with plants with accident records better than ours. For this reason no attempt will be made to compare our statistics with other plants, but, rather, a comparison will be drawn between our own record of a few years ago and at the present time. This is done because the reduction we have made is an appreciable one, and we hope may prove an incentive to those of you who are just starting out in safety work.

Our plant at the present time employs about 275 men of whom one-third are in the quarry. There is nothing exceptional about the plant or the type of men employed which was conducive to a reduction in accidents. On the other hand the conditions were perhaps unfavorable. The reduction, however, was made without any material changes in the organization or in the plant other than a natural growth in size. This point is mentioned here to show that conditions in our plant were no different from those in the average plant, and that such a reduction as has been made here can be made in practically any plant provided there is the desire and interest is aroused among the men.

To go back for a moment to the year 1922. During that year the lost time due to accidents at the Genoa plant amounted to 64 minutes for each 100 hours worked. At that time there were approximately 200 men employed, and our total lost time was equivalent to two men being off for the entire year. Unfortunately, we did not come to a realization of the seriousness of this problem at that time, and our record continued throughout the year 1923 at practically the same figure. In the meantime, statistics for all twenty-five plants in our company showed a reduction in lost time from 1922 to 1923 of 25 per cent, having dropped from 53 minutes to 42 minutes per 100 hours worked. The fact that the company as a whole had reduced lost time 25 per cent, whereas we had made no reduction, aroused our fighting blood and early in 1924 we came to the determination that we too could make a reduction.

A survey of the plant showed that our equipment was fairly well guarded, but we started at work installing additional guards so that every possible danger point would be covered. We soon found, however, that this was not reducing our lost time. Accidents continued to happen, and we came to the realization that a well guarded plant was only a very small step toward accomplishment of what we had in mind. A further survey of the plant showed that there were many places where serious hazards existed for which no guard could be provided except a careful workman. Wherever such a condition existed, a study was made and a set of safety rules drawn up to cover that particular point. As an example of this we have three gantry cranes hoisting rock from our quarry to the mill. These were notoriously hazardous machines, and three fatal accidents had occurred here prior to this time. After a discussion with the crane operators, the hookers and others concerned, a set of rules was drawn up governing the craneman, the hookers and all others who came within range of these machines. These rules were not only posted, but a copy was furnished to each of the cranemen and hookers and the reasons for the rules discussed with them. Another cause of frequent accidents was stone rolling down the piles in the quarry resulting in broken legs for those who didn't get out of the way. Signs warning of this danger were placed at several points in the quarry, the men's at-

*From a paper presented on October 1, 1925, before the Quarry Section at the National Safety Congress held in Cleveland.

tention called to them and the reason for placing them there.

By studying such hazardous places and discussing them with the men, their interest was stimulated and they looked at safety in a new light. As one man expressed it, "There may be something to this safety dope at that." This procedure, however, brought only a comparatively few of the men in contact with the safety work, and in order to bring them all in, an intensive, educational campaign was started to interest all of the men, their families and the community at large in our war against accidents.

We found a man in the plant who in addition to being a clever artist, possessed imagination, and with little effort he was interested in the campaign and started making home-made bulletins portraying possible sources of injury in our own plant and illustrating accidents that had occurred here. These bulletins aroused more interest than any we had ever used and drew attention to other bulletins in the new boards which had been placed throughout the plant. Large sign boards were also made and erected about the plant, bearing safety slogans which were changed from time to time. One of these in particular drew so much comment both among the men and from outsiders that it remains unchanged today. It is the one word, "Think," in large letters posted in a prominent location where all may see it when entering the plant. Another large bulletin board at the time clock house pictured some other race in which the contestants represented the various departments in the interdepartmental safety contest which was to run throughout the year. A "pennant" was made of sheet metal and painted, and was awarded each month to the department with the lowest lost time record.

Arrangements were made with the local newspaper for a display advertisement in the weekly issue, where an appeal was made to the men, their wives and children to join the Safety movement. A column was also run in the news section dealing largely on Safety and its benefits. Circular letters were mailed to the wives of the men in which they were urged to assist their husbands in cultivating safe habits. A little later an open air picture show was staged on the village park with a comedy for the little folks and safety films and talks for the grown-ups.

To many of you these stunts are old, but they were new in our plant and served their purpose in arousing the interest of the men in safety. We had a feeling that once that interest was aroused the men themselves would take the lead in the safety work. Already there could be observed a new spirit. Records showed that accidents were becoming less frequent and less serious. By the latter part of 1924 the improvement was so great that from October 15th to the end of the year there were no lost time accidents. The semi-annual no-accident campaign staged by the company in all plants in October meant more to the men than ever before because they now saw its importance to them. At the same time the inauguration of uniform safety committees and procedure gave the added impetus necessary to gain their full interest and cooperation. At the end of the year records showed that lost time had been reduced from 64 minutes per 100 hours in 1922 to 37 minutes per 100 hours in 1924, a total reduction of 42 per cent. I might also mention here that the company records showed a reduction from 52 minutes in 1922 to 28 minutes in 1924, a total of 46 per cent. We were still higher than the average but our reduction had been made in practically one year and under adverse conditions as during that year the plant had been increased in size about 50 per cent, the construction work having been done by company men and the accident record included in our plant record.

By the beginning of 1925 the men had become so interested in the safety work that they were taking the initiative themselves in an endeavor to make the plant the safest of its kind in the country. I have mentioned before that they worked from October 15th to the end of the year without a lost time accident, but they did not stop there. They continued to work without lost time accidents until April 20th of this year, a total of 189 days. Unfortunately, three more accidents occurred within the next twenty days. However, once a group of men become interested in something and really want to put it across, there is nothing that can stop them. Beginning again on May 11th they have worked until the

present time without lost time, a total of 142 days, and I hope they will continue until they have beaten their previous record which is the goal they have set.

To date this year there have been only four lost time accidents, all occurring within a period of twenty days. In fact these four accidents are the only ones that have occurred since October 15th of last year, whereas for the first ten months of last year there were 35 lost time accidents. The lost time figure for the first eight months of this year amounts to only 7 minutes per 100 hours worked, as compared with 37 minutes in 1924, and 64 minutes in 1923, a total reduction of 89 per cent in the past two years. For eight months this year company records for all plants show a lost time figure of 20 minutes per 100 hours, a reduction of 61 per cent since 1922.

There is one more point which I should like to mention and that is the reduction in accidents made in our quarry this year. You are all familiar with quarry work and realize the natural hazards which exist in it, particularly when you have a large number of men breaking and loading stone by hand on piece work. In spite of this the men in the quarry have operated for nine months of this year with only one lost time accident, and their lost time figure is only two minutes per 100 hours, as compared with 71 minutes per 100 hours last year, a reduction of 97 per cent. While we have other departments which have a lower lost time figure, we have none that have made any reduction approaching this. We accordingly consider our quarry the banner department and an asset to our safety work, whereas we formerly considered it a heavy liability.

While the reduction in accidents during this past year is due largely to the interest of the men, we have not decreased our propaganda but have perhaps increased it. Advertising safety is like advertising any other article. A desire can be created by an intensive campaign but unless you continue to advertise after that desire is created, the article will soon be forgotten. For this reason we have continued our propaganda using new signs, new bulletins and new ideas. The occasional group gatherings of the men have grown into regular monthly meetings at which talks on various phases of safety work are given by the men and others, and prizes awarded for the best suggestion submitted by an emloyee during the preceding month. The little metal pennant for the best department record has been replaced by a small silver loving cup. The newspaper propaganda has been continued and supplemented by a small monthly magazine, published under the name, "Lime Light," in which the last word stands for the light of safety which is guiding the men.

In conclusion, let me say again that the reason we have been able to operate with so few lost time accidents is because the men have grasped the real idea of safety and that when a group of men become interested in something and really want to put it across, nothing can stop them.

Underground Mining of Limestone

Limestone, which finds industrial use in the United States to the extent of approximately 120,000,000 tons per year, is obtained chiefly from open-pit quarries, but with gradual depletion of surface deposits, more and more operators are being forced to use underground methods. As quarrymen are not necessarily familiar with underground mining, a complete study of the mining of limestone in this manner has been made by engineers of the Bureau of Mines, Department of Commerce, with the object of determining the methods in use, ascertaining what constitutes good and bad practice, and suggesting improvements in methods when practicable. As a result, complete data were obtained, with the hearty cooperation of the industry, on 52 of the 64 mines known to have underground workings. The information obtained by the Bureau of Mines will be embodied in publications to be issued within the comparatively near future.

A. E. S. C. 1925 Year Book

American Engineering Standards Committee, 29 West 39th Street, New York, has issued the 1925 Year Book, which contains among its various chapters those on industrial standardization, purpose and organization of the A. E. S. C., committees, method of work, classes of membership, relation to industrial associations, etc.

Safety in Quarry Operations

By T. P. Kearns, Superintendent Industrial Commission of Ohio*

SAFETY *does* and *will* pay, gentlemen, in dollars and cents. The premiums on classifications which apply to quarry operations have been materially reduced in Ohio in the past seven years, in some instances, nearly 50 per cent. Some reduction in wage rates and reduction of exposure of hours worked have been factors in this but *unquestionably* the reduction of accident cost, due to the safety measures which have been adopted has been the greatest factor in this reduction of rates. Both the voluntary efforts of employers and the enforcement of the state laws on safe practices have contributed to this result.

A rigid observance of regulatory laws and requirements is a vital factor in the solution of your safety problems; these laws and regulations of the states governing safety and health are enacted for *your* protection just as much as for your employees; to guide you and help you to so conduct your operations as to make them as safe as the operations will permit. That is all that is contemplated in the minds of those collaborating in the construction and purpose of the laws. Just to make the operations as safe as can reasonably be done and still conduct the operations practically and efficiently. They are not intended to curtail production, they don't compel you to *spend* any money. In conforming with them you will undoubtedly be obliged to *use* some money, but I *say to you*, that any amount of money used to effect better working conditions in your plants, to make your plants better places to work, more safe, more healthy, is an *investment* only, and a mighty good one!

When, in the light of its experience, our Industrial Commission is convinced that there should be some specific lawful requirements and regulations of an industrial condition, it invites the manufacturers or operators in the industries involved to recommend a given number of persons to represent them; and the workers in those industries an equal number, who, with a representative of the Commission comprise a committee to draft a set of rules to cover the situation. When the tentative draft is completed this committee then holds public hearings, often at different points throughout the State, and the interested parties, and the public generally, are given ample notice of these hearings and invited to appear and discuss the subject for the guidance of the committee. I know of no instance when a committee has not profited and been governed by the information and arguments presented at these hearings in the presentation of its findings. Committees are usually frank to indicate their attitude on the matter before them and open minded to suggestion and argument. Therefore, if the adopted rules are not satisfactory to the affected interests, it is their own fault, if they have *not* appeared and presented their opinions at the hearings.

As a matter of fact, very little criticism obtains when these codes or rules are understood. I don't say they are perfect; we have occasion to realize that they are not. In spite of great care in their construction, they are usually inadequate to cover all situations clearly. Such ambiguities *may* operate against the employer. The more definite the safety laws *are*, the more protection they afford to the employer. He knows just what is required and if he complies with them, he is fully protected.

I sincerely believe that every safety law that is enacted is beneficial to the employer just as the Workmen's Compensation Acts have proved to be the most beneficent to the employers, of any statutes of the states. For this reason there should be more of them; the more there are, and the more comprehensive they are, the better *you*, as employers, will be protected from penalties and legal involvements.

Let this thought govern you: that the purpose of safety laws is to reduce industrial accidents; to protect life and limb in the great army of industrial workers of this country. I like to think, and I am confident, that every employer has at heart the welfare of his employees. He values

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his machinery and cares for it; how much more must he value and need to preserve the human lives without which the *machinery* would be of no value. You can't keep on killing them off without paying increased cost of inducting new ones, and in higher wages regulated by the law of supply and demand.

I said existing laws are inadequate; this is due largely to changes and improvements in processes and operations in production which have developed new problems. Such changes are always taking place and that means frequent revisions of existing laws and the enactment of additional ones. There is a need now in our State for work of this kind and action has already been taken to this end.

If the employers and the employees will co-operate with their legislative and administrative bodies in the construction of safety and health regulations I know that the results will prove so gratifying to all concerned, so efficacious, as to demand more, and even more, state regulations; because as I have said, and if for no other reason, it will pay in direct ratio to the regulation in reduced accident cost and reduced premiums as has been proven to a degree in Ohio and we hope to still further reduce premiums all along the industrial line.

If you are suffering from high liability rates it is only because your accident cost is high. Your insurance medium, whether state fund, stock or mutual company is only your agent to disburse your money and only requires you to pay it a sufficient amount of money to pay your claims, plus its charge, if any for handling the business. Your accident cost will be the same if you are self insured; you can't get away from it except by reducing the cost as I have tried to show; be guided by such laws as are laid down; consult with the authorities vested with the enforcement of the laws. The State Safety Departments are in a position to help you to a better understanding of the laws and the practical application of them. It will be the uppermost purpose of our new division to lend all possible assistance to the employers of our State to a reduction of their accidents and in all matters pertaining to the advancement of safety in all its phases.

In this connection I want to urge the adoption of a uniform standard of keeping lost time accident and occupational disease records from which periodical reports may be compiled and these reports assembled and tabulated. These tables would be distributed for comparison. There is *nothing* more stimulating to safety work than the competitive spirit engendered by a comparison of accident experience in a particular industry; but these experiences are comparable only when tabulated from standard forms used by all of those making reports. There should be no objection to submitting such reports for circulation for the identity of the plants *need* not be disclosed but numbers used instead; each knowing *only* his own number on the list. That, however, is only a detail and with the thought that "honest confession is good for the soul," I believe a frank interchange of experiences between plants would be helpful to all and the plant with a high, or bad, record need not be ashamed *if* its management is desirous of and determined to improve it.

These are only factors, however, in the solution of the safety problem. The laws are only rudimentarily fundamental, to pave the way for better things; to inspire you to do more than just what the laws require.

After more than twelve years' experience in the administration and enforcement of factory laws and regulations, I am convinced that a mere arbitrary enforcement of certain mandatory laws will not alone suffice to accomplish the desired results in accident prevention work. A very important and essential factor of the problem is educational safety work and that cannot be controlled by legislation but must be promulgated and maintained spontaneously by industrial management through the medium of proper safety organizations within the individual establishment.

I do not know if safety organizations made up of Safety Committees composed of foremen and employees of the plant are anywhere compulsory but I do know that a credit in the premium rates is allowed by insurance companies for such organizations and there can be no question of the value of this plan in promoting safety in the plant. The complexion of these committees, should of course, change periodically as every person who serves becomes imbued with some ideas of safety more than be-

fore and the result is a gradual but sure development of the safety spirit throughout the organization.

Education in safety is, after all, necessary to its achievement. Many human beings are inherently careless and must be taught and trained to *think* and *act* safety and we cannot expect an observance of laws that are not understood. When *you*, as employers, are converted to the doctrine of safety and when *your employees* comprehend that every safety measure and rule is for their protection against injury or death, to save them for themselves and their dependents, then, and not until then, may we hope to accomplish what is contemplated by the laws when they are enacted.

And, gentlemen, let me say this; it is useless to *attempt* anything in this direction with hope of results unless you yourselves, as owners and managers, are firmly committed to the sincere purpose of making your plant a safe place to work. You may execute the instructions and orders of your State, you may carry out the recommendations of your insurance carrier, organize safety committees, display bulletins, etc., but unless the spirit of safety emanates from the *fountain head*, unless the boss preaches safety and means it, you won't go far. Don't fool yourselves for you won't fool anybody else. Your employees will quickly discern whether you are, or not, sincere and you can't expect them to go any farther than you lead them. You will, however, find them, or least the great majority of them, anxious to please and ready and willing to follow your lead. They will realize what it means to work where their interests are considered. They will appreciate what it means to work in a safe place. Their families, those most concerned, will appreciate what it means to have the assurance, the confidence, that the husband, the father, the son, the *bread winner*, is being protected and saved for them; able to work every day and bring home the full pay envelope so necessary to their existence. No danger of injury and its physical suffering or the lost time with its attendant shrunken income, deprivation and mental anguish.

Your workers won't want to leave a place like that; their families will oppose any thought of change. Your turnover will be reduced and you will breed a feeling of happiness and contentment which will pervade your whole organization. I need not dwell on what this stabilized force means to you in greater efficiency and reduced operating costs. It is proving out all through industry. It is progressiveness; and *progressiveness* means *success* and the quarry man who doesn't get in line will have cause to regret his lack of farsightedness sooner or later.

Winter Construction Increasing

The building season is gradually being lengthened as the result of a drive undertaken by the Construction Industries in co-operation with the Department of Commerce. This fact has been established through a survey made by the Division of Building and Housing of the Department at the direction of Secretary Hoover to determine what results were being obtained. Reports from contractors in sixteen large cities show that payrolls and material purchases were relatively larger in the winter months of 1924 than in those of 1923. The 1923 figures in turn showed an increase over 1922. Payrolls and material bills are measures of building activity which follow actual work very closely.

The large number of contractors who answered the Department's inquiry gave figures showing for each month the percentage of the year's total. Practically all replies had the same trend, making an average a fair statement of conditions as given. Changes in general business conditions and a difference in the weather undoubtedly had some share in the result. But making allowance for such factors, a distinct improvement in the relative amount of winter building is apparent.

There are already favorable indications for the coming winter. The August figures for contracts awarded for all classes of construction have proved to be the highest ever known. Many of the operations represented by these contracts will undoubtedly be carried over into the cold weather.

All groups in the building industry are trying earnestly to bring about a more equal distribution of work throughout the year. Their efforts are bringing results. More and more people are becoming convinced that winter construction is both practical and economical.

The New McMyler Interstate Gas Shovel

In adapting the gasoline engine for shovel service, there are several mechanical difficulties which must be surmounted. Whereas a steam shovel has separate engines for hoisting, swinging and crowding, these three functions are performed by a single motor on a gasoline shovel. The use of friction clutches is therefore necessary, and it is in the design of these clutches that gas shovels vary most widely.

Considerable physical effort is required to set a friction clutch so that there will be no slipping and the problem is to reduce this effort to a minimum. On a steam shovel the main hoist clutch is set by a steam-ram. On a gasoline shovel various methods have been devised for setting this clutch.

The McMyler Interstate Number 2 gas shovel solves this problem in a unique manner. The same ram mechanism which is used on all standard steam shovels is used on the Number 2 gas shovel. Compressed air does the work of steam in setting the clutch. The air compressor and pressure tank for supplying air take up less room on the turntable than the swing engine on a steam shovel. The only manual effort required to set the hoist clutch is that required to open the air valve. Not only easy operation, but the flexibility of a steam shovel is secured by this arrangement. The ram mechanism employed has the further advantage of being thoroughly understood by all steam shovel operators.

The crowding mechanism of the Number 2 gas shovel also represents a distinct advance. The shipper shaft is driven by a single chain from a sprocket on a shaft concentric with the boom hinge. This drive makes it possible to raise or lower the boom without altering the length of the crowding chain. The clutches for reversing the direction of the crowding motion are located on a shaft at the boom foot. These clutches are driven by spur gears and, in fact, there is not a single bevel gear in the entire crowding mechanism.

The crowding clutches and the swinging clutches are operated by means of an eccentric device which so multiplies the force applied to the respective hand levers that practically no manual effort is required.

Another refinement in gas shovel design which is embodied in the Number 2 is the manner in which water is used for cooling the engine and for counterweight. Located at the rear of the turntable is a large capacity water tank. The cooling water for the engine is circulated through this tank, thus eliminating the necessity for a radiator and fan. A constant operating temperature for the engine is obtained. Even when operating in freezing weather, this system has proved its practi-

The New McMyler Interstate Shovel

cability. No alcohol or other anti-freezing compound is necessary under normal winter conditions. By drawing off this cooling water, the weight of the shovel is reduced considerably. This is an important factor when transporting the shovel over long distances.

The Number 2 gas shovel is furnished with two independent power drums with air-operated clutches on each drum, making the shovel readily convertible to a 10 ton crane for clam-shell or dragline bucket service. A worm driven boom hoist is standard equipment. As a shovel, this machine handles a ⅞ or 1 cubic yard dipper. Used as a locomotive crane, it is rated at 10 tons capacity in accordance with the standard rating tests of The Locomotive Crane Manufacturers Association.

Bucher Goes to Japan

Mr. G. H. Bucher, assistant general manager of Westinghouse Electric International Company, has left this country to spend some time in Japan, where he will assist in the newly formed Westinghouse Electric of Japan. He will also visit several of the Far East countries to make an investigation into the electrical business outlook there.

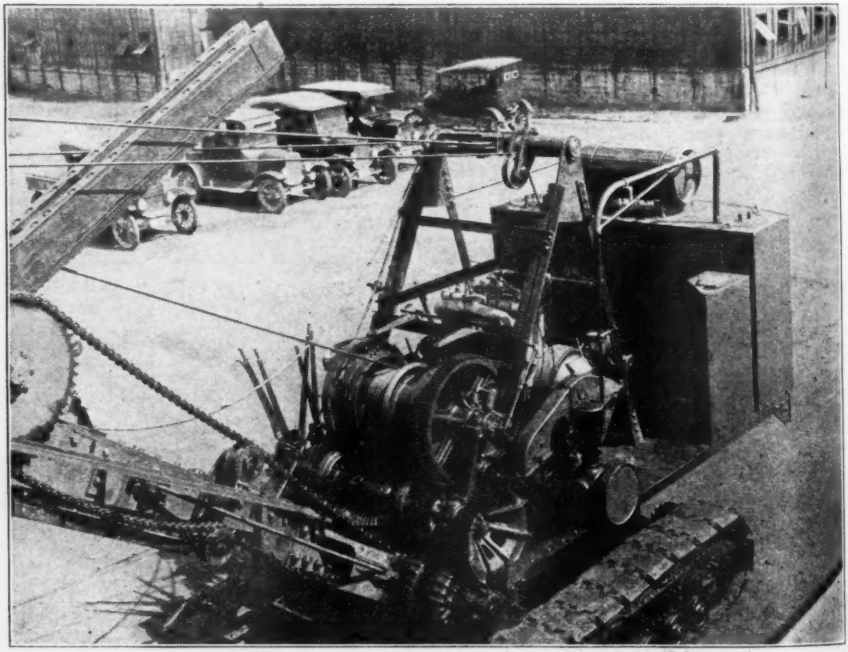
Bakersfield Plant Under Construction

The Bakersfield Rock and Gravel Company has started construction of its 1000 ton rock, sand and gravel plant according to announcement made by C. F. Smith, secretary of the company. The building of the plant entails an expenditure of $100,000.

The plant will be equipped with the most modern machinery and will be one of the finest in California. The construction of the plant will be completed as soon as possible in order that Kern county contractors may be furnished with a Kern county product.

New Link Belt Catalog

Link Belt Company of Chicago has issued Book Number 720 containing 68 pages of illustrations and description of the Peck Carrier for coal, ashes, cement, sand, ore, stone and other materials. In addition, this book contains illustrations showing installations of the Carrier in boiler houses of public buildings and in many industrial plants throughout the country.



The McMyler with Hood Removed Showing Mechanism

A New Labor Saving Feldspar Mill

By George Ransom

CONSTRUCTION of the new mill at West Paris, Maine, by the Oxford Milling and Mining Company of Portland, Maine, has been completed. The product marketed by this company is known as Oxford Crystal Spar and is a very good grade of feldspar, without free silica and reducible to a good uniformity of color and fineness of grain and fusion.

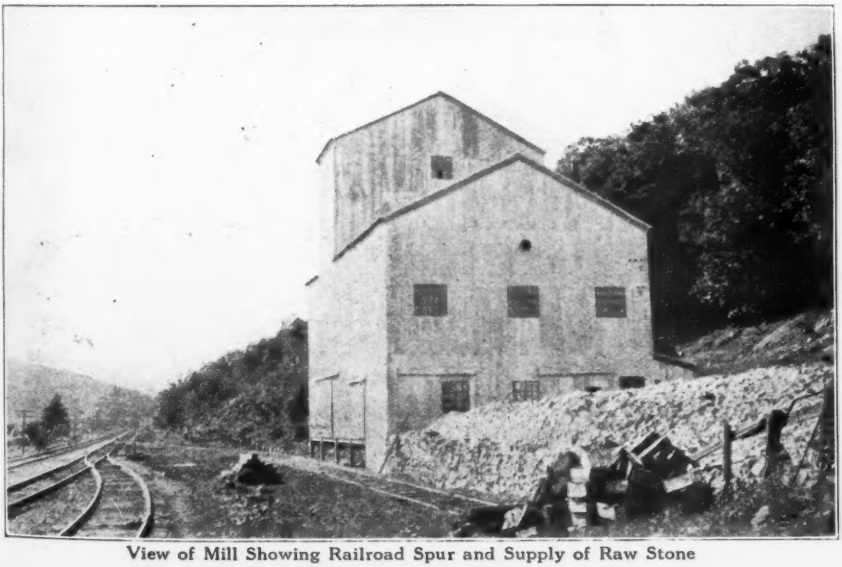
The mill is completely electrified and very fully equipped with modern machinery and labor saving devices. The building has a steel framework furnished by Jones and McGuire of Portland, Maine, and it is sheathed with corrugated galvanized steel made by the Republic Iron and Steel Company. It is situated on the main line of the Grand Trunk Railway between Portland and Montreal, and, as shown in one of the illustrations, there is a spur up to the loading platform so that bags of finished product may be loaded on freight cars with a minimum of handling and danger of wetting in bad weather. A large quantity of raw stone is kept in reserve in the storage yard, which is adjacent to the primary crusher. The latter is located in the left hand corner of the building.

The stone, already broken up in comparatively small pieces, somewhat suggestive as to size of stone prepared for charging lime kilns, is first crushed in a Reliance jaw crusher. At present it is fed by hand, but it is quite probable that some kind of conveyor, probably a belt, will be installed to carry stone in from the outside and drop it into the crusher.

This crusher is driven by a 25 H.P. General Electric 440 volt squirrel cage induction motor. Leather belting proved to be unsatisfactory for this drive but a rubber and canvas belt, 7 inches wide, gives good service, even in this very dusty location.

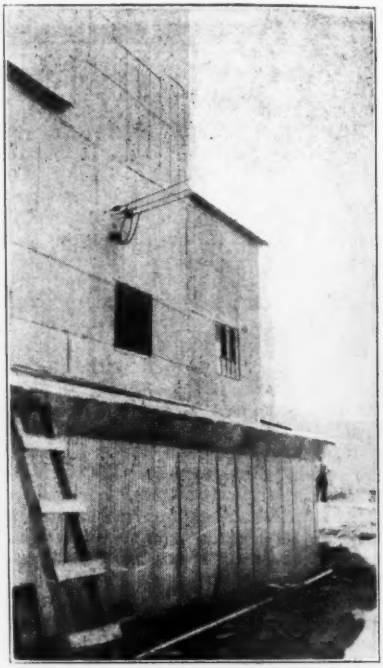
The crushed stone is carried by means of an elevator to a chute through which it descends into a hopper. From this hopper it either enters the Ruggles Cole rotary dryer or drops upon a belt conveyor.

The Ruggles Cole dryer is used almost exclusively during the winter season when the stone is wet from melted snow. In summer it is generally uncalled for. The stone passes through the dryer, which is driven by a 20 H.P. General Electric, 440 volt, slip ring induction motor, and drops into a pit where it is picked up by an elevator and deposited in an overhead concrete bin. If the rotary dryer is not to be used, the

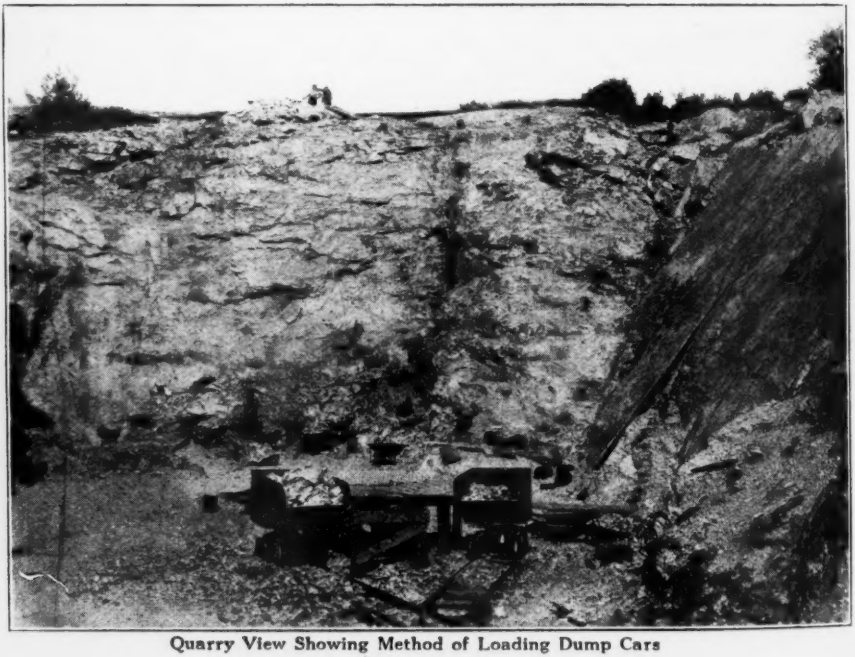


View of Mill Showing Railroad Spur and Supply of Raw Stone

Showing the Feed to Crusher, Also Elevator and Hopper



View of Side of Building Showing Entrance of Low Voltage Feeders

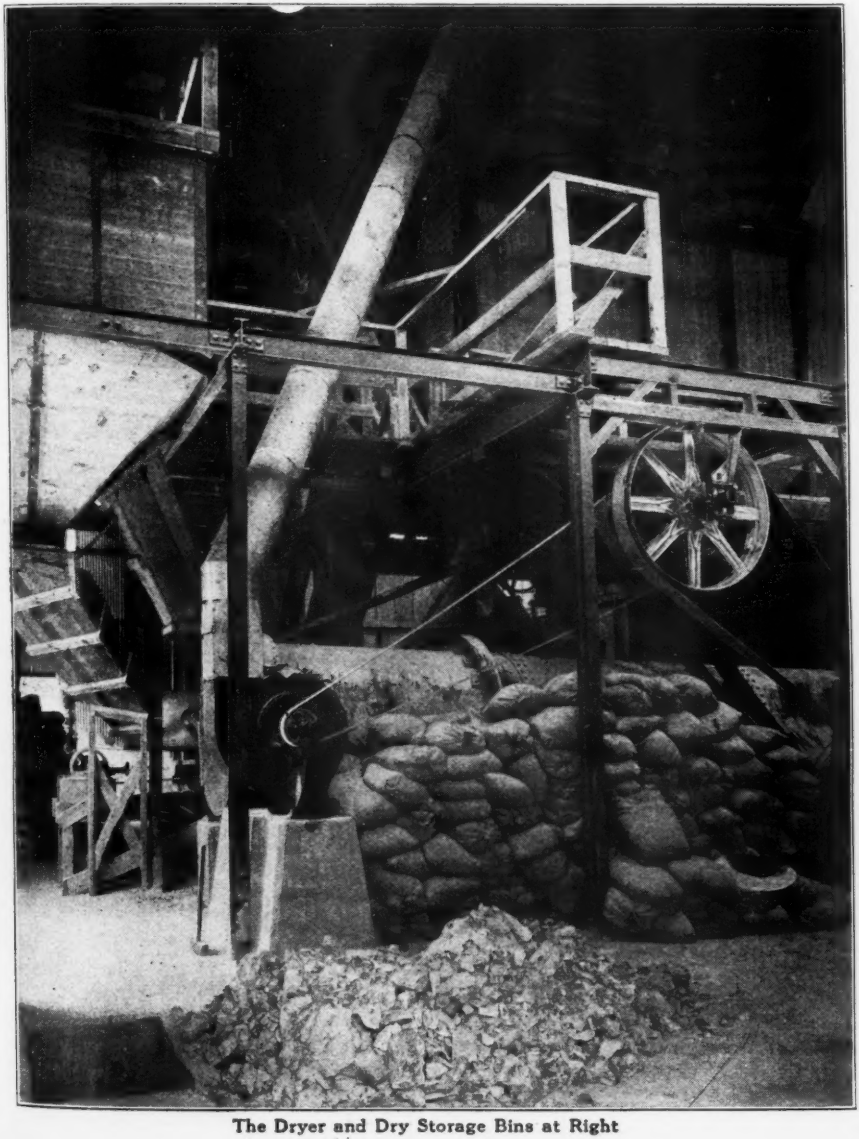


Quarry View Showing Method of Loading Dump Cars

crushed stone is carried on a belt conveyor, Link-Belt Uniroll, to the elevator at the end of the dryer and thence by it to the concrete storage bin. In either case it first passes through a dust collector on the top of the bin. A blower, Buffalo Type L Planoidal size 35 inch, blows hot air from the dryer into the bins as additional surety against dampness.

It will be noted from the illustrations, that the floors, bases for machines, bins and hopper for the dryer are of concrete. These illustrations also give a good idea of the steel framework of the building.

From the dry storage bins the crushed stone descends through a chute by gravity to a Harding mill. This is a pebble mill with flint stones about the size of small cobbles. The drive for this machine is a 75 H.P. General Electric slip ring motor, 440 volts, which runs the mill by means



The Dryer and Dry Storage Bins at Right

of a Link Belt silent chain drive. All wiring is in conduit and the motor leads are in conduit laid in the concrete floor. One of the illustrations gives a good idea of the construction and support of the concrete dry storage bin.

Dust from the Harding mill is carried off by means of a Morrison and Foss Blower, Type C, driven by a 15 H.P. General Electric squirrel cage motor, through a pipe to the outer atmosphere. If warranted, this dust will later on be collected.

Material from the Harding mill is carried by means of an elevator to a Gayco centrifugal air separator at the extreme top of the building. The Gayco air separator is driven by a 15 H.P. General Electric squirrel cage induction motor. The finished material is deposited in the large

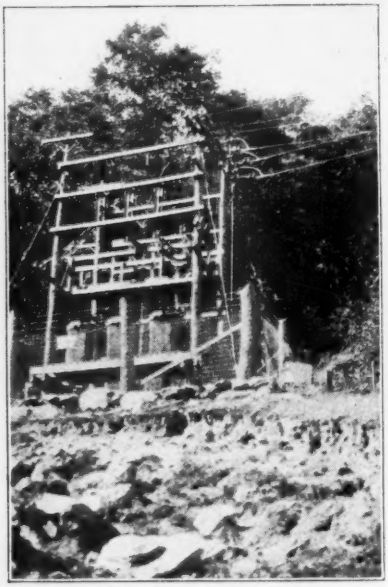
The Air Separator and Finished Product Bins

concrete bin shown in one of the illustrations and the coarse material which has been separated out collects in the small wooden tank whence it descends through the wooden chute back into the Harding mill. A metal pipe from the top of this small tank extends through the roof to carry off dust.

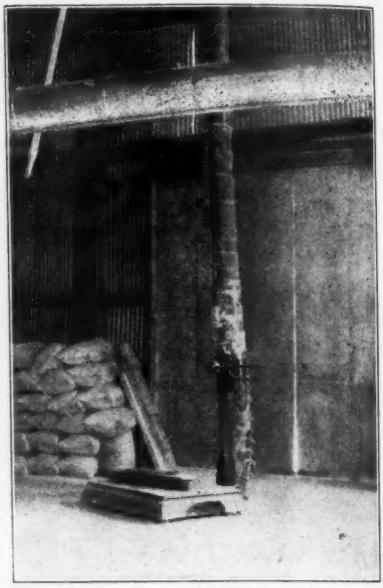
Openings from the bottom of the finished product storage bin are fitted with Link Belt flexible spouts as shown in one of the illustrations. They are located adjacent to doorways opening on to the freight siding for convenience in shipping. The bags are set on Fairbanks scales for filling.

The equipment described is designed to turn out from 2 to 2½ tons per hour with 4 men and a superintendent. This small complement is

Interior View Showing Pebble Mill



Outdoor Transformer Bank



Flexible Spout for Filling Bags

possible because the only points at which constant attendance is necessary are for feeding the crusher and bagging the finished product. It is planned to run two shifts when market conditions warrant.

Central station power comes in at 33,000 volts to an outdoor transformer bank. It is stepped down to 440 volts and is brought into the plant through an aerial entrance. This is located directly above a main disconnect switch. The wires being in a vertical conduit enter the top of the box. It is a very simple, clean cut and safe arrangement obviating all unnecessary expense. The shafting, steel hangers, pulleys, belting and buckets were supplied by W. L. Blake and Company.

A description of this plant would not be complete without mention of the quarry from which the feldspar is obtained. It is located about a mile from the mill on the side of a small mountain. The rock is broken up into proper sizes by workmen at the breast of the quarry and placed in wheelbarrows. These are then pushed up an incline to the platform shown in the illustrations and dumped into the end dump cars made by the Atlas Car and Manufacturing Company. The dump cars are pushed along the tracks to a point where they can be discharged into trucks for haulage to the mill.

Deformation of Molding Sands

Experiments to devise a method for running softening temperature determinations on molding sands have been conducted by the Bureau of Mines, Department of Commerce, at the request of the committee on molding sands of the American Foundrymen's Association. Experiments have been completed and a report to the committee is being prepared for its guidance in formulating the conditions under which molding sands should be tested for refractoriness. In this work it has been necessary to determine first the effect of furnace atmospheres on the raw sand, the washed sand, and the bond used in forming the sand into molds. Six typical sands were selected and these were tested under both oxidizing and reducing conditions. The softening range of the sand was determined on cones and test bars.

Asphalt Plant Near Completion

The Kentucky Rock Asphalt Company, Bowling Green, Kentucky, will soon start production of rock asphalt at its new Green River plant. The branch line from the mines to the plant has been completed and engine and cars for hauling received and plant equipment is rapidly being assembled.

Fatal Accidents in the Cement Industry

By R. Frame, Alpha Portland Cement Company*

COMPLETE statistics giving the grand total number of lives lost in all industries each year throughout the United States are not available. Whether the figure is 21,000 annually or 35,000 it makes little difference to us today, for it is my opinion that we can safely proceed on the conclusion that whatever may be the exact number, it is much too high. The primary object of accident prevention work should be to save human lives. The reduction of other types of injuries is always to be commended, but we should not be prone to dismiss a fatal accident with the customary obituary, "I'm sorry for him—it was his own fault." Or, in case we know it could not be justly laid at the door of our dead comrade, we reason "He's dead now—nothing we can do will restore him to life; why stir things up at this time and likely bring about more trouble?" There are cases though where following a fatal accident a guard will be immediately put in place. Nobody seemed to realize the danger prior to the accident.

Since compensation laws have been in force, many states publish accurate figures as to fatal accidents each year. When we read of men being killed as reported in the daily papers from different locations, it does not leave us with a very deep impression. Perhaps a few reports will help us today to realize how much hard work there remains yet to be accomplished before we reach the front ranks in our safety battle. Nine years in Pennsylvania show 22,677 fatal accidents. It required $19,000,000 to pay the cost of Workmen's Compensation in the State of New York for the period of one year ending June 30, 1924. The Cement Industry composed of plants in United States, Canada, Cuba, South America, etc., contributes generously to the state and national totals.

From the records published by the Portland Cement Association, and I regret to state that some plants did not report their fatalities in the early years of our tabulated experience, I find that the number of men killed in our plants represents the wiping out of one complete plant organization every six years. Suppose all fatalities could be confined to any one plant, what would be your opinion of your safety educational work, your bulletins, your supervision when you saw one-sixth of your men killed each year. The fact that in 1924 the 60 deaths were distributed among 53 plants should not make very much difference in our attitude toward this important duty. As I see it, we belong to a common family and every single death should cause us to pause, think about why it happened and then ascertain our personal duty to prevent a recurrence.

Mr. Jacobsen, Manager, Bureau of Accident Prevention and Insurance, Portland Cement Association, presents a fine comparison of the experience of the cement plants this year by dividing them into groups representing 25 per cent of the total plants. The first group is the only one which can show any material progress in the reduction of fatal accidents. The other plants continue to kill employees with marked regularity. In 1921 the first group killed 6.7 men for every 10,000,000 man hours worked. In 1924 they reduced them to 2.6 men. The record of the other plants is: 1921 7 men and 1924 8.4 men.

In 1913 the average record for 88 plants in the Cement Industry was 8.2 deaths, and during 1924 the average record is 6.8 deaths. The credit of the reduction can in my opinion be awarded to the first 27 plants in the 1924 study. During the past six years only four plants have been free from fatal accidents. Since 1913, the cement industry has recorded 566 deaths. Of these 146 are charged to the quarry and clay field. Granting that the men employed in this group will equal about 20 per cent of the total plant force and that the use of dynamite, haulage systems, weather conditions and rock slides increase the inherent hazards of this group beyond any one department of the plant, we may state that 25 per cent of the deaths is not far out of line. Then come the crushing and raw departments which in combination contribute 107 deaths. As compared with the quarry there are far too many men killed in this branch of our operations.

*A paper presented on September 29, 1925, before the Cement Section at the National Safety Congress held in Cleveland.

Putting it another way if the clinker grinding department shows 50 deaths, the kiln room 41 deaths, the power house, 20 deaths with an average of 37, then the crushing and raw departments have no grounds to justify their 107 men killed.

Look at this grand performance of our coal grinding departments. Three men on a shift, a coal dryer, one or two grinding units, a department which handles about one fourth the tonnage of either the raw, burning or finishing departments, whose hazards are well known and fully admitted—yet we turn in 59 deaths. Compared with the quarry record of 146, it would appear that we have identified culprit number 2. The yard gang shows a record of 30 deaths. Here is where many new men begin their service; their work is scattered and varied. It would pay us to direct more efforts to safeguard these men. The causes of fatal accidents remain very much the same from year to year. Comparing 1913 with 1924, I shall quote just a few items. You should keep in mind that the man hours worked in 1913 are 50 million and 1924, 88 million.

	1913 Fatalities	1924 Fatalities
Rolling stones in quarries and fall from face	3	10
Machinery	16	16
Smothered by slides of material in bins	7	5
Coal dust explosions	1	3
Electrocutions	2	3
Machinery being started	0	3

If we are to reduce the fatal accidents, to me it seems essential that every plant organization should devote more time to study of death experience of the industry as a whole. In the period from 1923 to 1924 there was not more than one man killed at any one plant. If you have had no deaths or only one man killed in the space of two years, you do not have an opportunity to consider fatal accident hazards to any great extent. The study of accidents prepared by Mr. Jacobsen each year gives you accurate information, well prepared and better compared. Of course we are interested to learn how our plant stands and what our personal record may be. Perhaps we read every figure and every work in the bulletin. We note that so many were killed and the brief explanation recited on each death. Then after a two or three hour study, do we lay the bulletin aside and give these deaths no more serious thought until next year's study is received? In the first eight months of this year 36 deaths have been registered. Since Jan. 1, 1922 the cement industry has taken husbands away from 127 widows and killed the fathers of 288 children who are all under 18 years of age. The remarkable features are that 10 men had been employed less than 30 days, while 16 men were employed for 10 years or more. One hundred twenty-two English speaking men were killed as compared with 83 foreign and it is safe to assume that approximately 40 of these could understand the instructions pertaining to their duties.

Upon reading over certain reports on the 205 deaths which have occurred from January 1, 1922, the following questions came up in my mind and then I listed them to see what answers we could offer. The particular accident quoted will help you to understand clearly the thought behind my selection.

How many deaths can be charged to the injured man himself? 39 deaths. 2-1. Deceased was placed on siding to block clay car being switched. He placed block under car wheel but it did not grip. He then took his foot off the block and block fell inside the rail. He reached after the block with his right arm but did not get it. He again reached for the block and this time his right arm was caught between the wheel of car and the rail, the wheel passing over his right shoulder and across his back, killing him instantly.

How many deaths can we say are unavoidable and probably beyond immediate control? 24 deaths. 2-28. Rock fell from quarry side, striking man on head. 3-1. Man was drilling below bank when a hole the powderman was loading exploded prematurely, throwing rock on top of him. 4-2. Explosion of dynamite that did not all explode when a shot was made 2 hours previous.

Are guards needed in some plants? 9 deaths. 2-20. While deceased was cleaning the kiln chamber with an iron bar, apparently the bar fell in the screw conveyor and in endeavoring to pull the same out, the man fell into the conveyor. 3-35. Caught in screw conveyor while cleaning it. 4-23. Caught in king gear of kominuter. 5-31. Was caught between master gears of the coal dryer.

Do we need better supervision when

we assign our workmen to work storage piles, bins, tanks, etc.? 25 deaths. 2-35. Evidently man went down the material bin and in trying to punch material loose, slipped into tunnel tap hole and in trying to catch himself, knocked shale loose which covered him up, causing him to be smothered to death. 2-37. Covered by slide in gypsum storage. 3-2. No witness to accident. Man entered rock bin to dig down rock while rock was being drawn out through hoppers under bin. Rock passing out caused slide which covered him. 3-5. Was removing sheet iron cover from grating of screw conveyor preparatory to filling same. Cement from over him. 4-9. Deseased was shoveling stone in bin. He was wearing safety belt and rope. A slide took place, carrying deceased down with it. A second fall of material fell on him which broke the rope attached to the safety belt, thus causing him to be completely buried.

Do we need to specialize in our educational work among those who have anything to do with the coal preparation plant or who have duties with the use of pulverized coal in kiln room? 14 deaths. 2-29. Coal miller was burned to death by an explosion, cause of which is not known. 4-39. Compressed air was being blown into pulverized coal bin to clean it out. The dust coming in contact with a fire smoldering in the bin caused an explosion. 4-41. Coal in coal dryer caught fire just as injured came around screw, fire caused explosion, igniting clothing. 5-12. Found sack over end of spout smoldering and while pulling sack off spout, ignited coal dust, causing puff of flames catching fire to man's clothing.

Can you look for explosions? 3 deaths. 4-18. While firing boiler, boiler tube burst, letting hot water on the fire and blowing the fire and steam through fire doors.

How many chains, ropes, cables, do you use about your plant to hoist different sorts of m a t e r i a l ? Why shouldn't you count on their failure? 9 deaths. 2-27. Fastening on car broke while car was being dumped at head of incline. The car started back down incline a distance of 600 feet, striking and killing a man in the way. 2-42. Several cars broke loose from the train as it was coming down the grade to the crusher plant. A man was out on the trestle near the crusher when he heard the danger signal sounded by the engineer. He ran to get into the crusher building, but was struck by cars before reaching a place of safety. 4-43. Operator of crane had started to lift load with boom almost directly over the center of load when cable broke. Load was a piece of machinery, cylindrical in shape. Book struck near end of cylinder, glanced sideways and came down on man. 5-3. Gear being taken down from car. Chain fall hoist broke, releasing pulley, which struck head and shoulders of man. 5-35. Small derrick was being used to transfer boiler tubes from spot on incline track between coal house and repair shop to areaway in front of kiln room. When load was about 20 feet in the air, the cable broke. Load fell on man who was passing directly underneath.

Will belts and couplings seize you like a bear trap? 7 deaths. 4-13. Coat caught on crusher coupling and wound around shaft and feet hit second shaft in going around. 5-32. Was applying belt dressing to Mosser rolls. Got too near pulley and gloved hand was caught between pulley and belt.

Can you put certain deaths up to a fellow workman? 2 deaths. 4-14. While assisting stack erector in building scaffold preparatory to taking down old stacks 2x6 timber was knocked off roof, striking deceased on top of head as he was coming up ladder.

Do stones fly from blasts? 4 deaths. 3-49. Rocks from blast in quarry flew into mill and yard, one large rock striking man on head. 5-8. Hit by rock which traveled across quarry and through side of building.

Should you be on the alert during excavation work? 2 deaths. 2-12. Working in excavation for new crusher building, bank caved in.

Is it worth while to lock the motor control apparatus? 1 death. 4-54. While working on elevator pulley, the elevator was started, crushing him between pulley and belt.

Can your men make a mistake when gathering up loose powder? 3 deaths. 5-19. Steam shovel uncovered misfired hole, exposing powder. Man used shovel instead of hands in gathering up powder and powder exploded.

How many cases can you name where the workmen failed to heed a specific warning or to use safeguards provided by the plant management? 7 deaths. 2-14. Was helping blasters. One hole failed to go off. Man was

instructed by blaster not to connect broken wire with power line until switch was pulled out. Regardless of the instruction, he connected the wires, setting off the blast and was killed. 2-17. Was standing on loading tracks. Another man on top of a car warned him that car would be moved. Brake was released and car set in motion when the man on the ground tried to get across and was caught between bumpers of cars.

Are high tension lines dangerous, are men killed by even low voltage and has the plant electrician an every day duty to follow up the condition of the apparatus? 15 Deaths. 2-15. Plastering walls of crusher building, he got too close to high voltage lines carrying 12,000 volts. 3-36. Climbed on gable roof under high tension wire. Started down same way and came in contact with wire. 2-22. Was adjusting electric light preparatory to entering tube mill. Electric light bulb was attached to an extension cord. It is claimed in making this adjustment, he received an electric shock resulting in death. 2-43. Man broke an electric light bulb attached to an extension cord. He attempted to remove the broken part on the socket while standing in slurry and received a shock which killed him instantly. 2-51. Had hung chain falls on wire rope cable, strung between trusses. Leaned forward evidently touching the wire rope with one hand and live 440 volt electric cable with other, and was killed instantly. 4-34. While climbing from the top of crane bucket to the bottom flange of the crane girder, he accidently grabbed or stepped on an electric wire.

How effective should we make our safeguards? 3 deaths. 2-9. Man slipped and turned so that his foot and leg went into a screw conveyor. The construction of this screw conveyor is such that it was believed impossible for anyone to get into it. 4-21. Was feeding coal to conveyor. Coal is fed through a hole into conveyor which has an iron grating over it and ¼ inch steel bars across it, to let coal through. Man stepped on these bars and his foot went through in some way and he was struck by the conveyor a number of times.

Do we have auto deaths, too? 2 deaths. 2-19. Deceased was sent on an errand and while on public street was run over and killed by a motor car.

There are miles of railroads on every hand which antedate our industry. How alert are our men? 12 deaths. 3-14. Was cleaning track, working between rails when he was struck by rear end of empty rock train. 3-45. Run over by the rock train. 4-12. Crawled under skipcars which were being spotted for shovel, to protect himself from blast and cars passed over him. 4-36. A cut of 7 empty cars coming down a 2½ per cent grade side swiped rear end of engine, resulting in the tearing out of four stud bolts which allowed steam and hot water to escape on man. 5-11. Had thrown switch for dinky, engineer ran headon toward man, who missed step in trying to get on riding board, fell and dinky ran over him.

Did you ever follow your oilers? 3 deaths. 3-28. While o i l i n g was caught in chain and hurled around shaft. Killed instantly. 5-18. While oiling in stone dryer, he leaned over line shaft and clothing caught and wound him around shaft.

Why jump into tank without some forethought? 3 deaths. 2-45. Three men were cleaning out elevated water tank. Deceased heard calls for help and ran up ladder to top of tank. On arriving at top of tank, he saw men lying down overcome by gas. He was cautioned to put on rope but he would not wait for this to be done, saying he had to get down inside to help the other men. He was overcome by gas.

You can't bet that surgical skill will always save your life. 1 death. 2-50. Injured had thumb pinched between stone and chute while removing stone. Died from blood poison two weeks later, although he apparently received proper medical attention from the beginning.

Is blood poison always within easy call? 3 deaths. 2-21. Deceased stepped on nail in board. He died from blood poison eight days later.

Why not teach our employees to swim? 2 deaths. 4-29. Three men were on a raft to inspect intake tower. Raft sank. Man was unable to swim and was drowned.

Do you use safety wrenches on coal cars? 1 death. 3-18. While opening a car of coal, lever struck him on forehead.

Should we respect the smooth line shaft? I'll say he bristles with danger. 2 deaths. 5-29. Was putting caster oil on a belt. To do this, he leaned over a running line shaft.

Can we make our scaffolds safe? 1 death. 4-5. Injured was working on scaffold which was attached to deck of movable forms inside new sack house, when scaffolding broke, causing him to fall 42 feet onto concrete floor.

Should you look for gears, pulleys and sheaves breaking away from confinement? 3 deaths. 4-45. Elevator became blocked. The packed material was partly dug out and the elevator was then started. Man was at foot of elevator watching to see if chain and buckets were on tracks. Main gear at head of elevator broke, striking him on hand.

Do they always guess right? 2 deaths. 3-38. Was overseeing taking down staging. One man was tearing braces from staging while another was pushing against part nearest to deceased, expecting it to fall in opposite direction from them, but the first two pieces fell at right angles from building and last two fell parallel with building in direct line of deceased, hitting him on head and breaking his neck.

Where do they sleep? 2 deaths. 3-32. Injured being temporarily idle owing to stoppage of mill, lay down on belt for a nap. Belt was started and he was carried under a discharge spout and crushed between the belt and spout. Sept. 24, 1925. Franklin Damer, a well known young resident of Eagle Point, near Egypt, Lehigh county, was almost instantly killed Thursday, when he was struck by a dump car at the plant of the Whitehall Cement Company, Cementon, where he was employed for several years. Damer, who was 31 years of age, died a short time after the accident from a fractured skull. Seeking a rest after several hours of arduous labor, Damer placed a board between the rails of a narrow gauge railroad over which passes small electrically operated cars used in hauling stone to a grinding mill. He was asleep on the board, one end of which was perched on the pumper of a car. Unaware of Damer's perilous position another employee started the motor on the car, the bumper of which struck the sleeping man on the head, causing a multiple fracture of the skull.

How was this man killed? 1 death. 3-39. Putting fasteners on belt, preparing to put belt in service. Owing to the late hour and being in a hurry to finish the job to get away on time, evidently did not use precaution.

Profiting by the experience in other industries, I believe that before the Cement Industry can expect to secure 100 per cent co-operation, every plant must be promptly and fully informed regarding the death accidents which are necessary and will prove beneficial.

My suggestion is as follows:

1. Once each week the Portland Cement Association to mail to each plant a copy of immediate report of every fatal accident to date.

2. The name of the company and the man's name not to appear in this special bulletin, but in its place should be substituted the number of the fatality. It should carry a standard picture of hazard which can be applied to many accidents such as electric shock, gears, belts, dynamite, coal dust, locomotives, etc.

3. The size should be about three times the present immediate reports.

4. If so desired, member companies should be assigned the reports of death cases which occur in other member's plants with the request that they prepare the comments, so that we may in time gather better ideas of how various hazards are controlled in different parts of United States and elsewhere.

5. Accidents in 1924 cost the Cement Industry more than ¾ of a million dollars, so that the cost of these death bulletins is rather insignificant.

6. Member plants to call each bulletin to attention of each foreman, then to members of Plant Safety Committees and then to post it on a special bulletin board to be kept neat and clean.

Aerial Tramways

Readers of Pit and Quarry, who are interested in aerial tramways and their application in material handling problems of the non-metallic mineral industries will find much information of value and interest in a booklet published under the title of Aerial Tramways, by A. Leschen and Sons Rope Company.

The Leschen Heavy Duty Friction Grip, the Leschen special automatic, the Leschen two bucket, and the Leschen single carrier systems are discussed in detail and this description is supplemented with many actual illustrations of the various systems actually in operation. The operation of a typical installation in each case and the details of the equipment involved are presented.

Sand and Gravel Output

The output of sand and gravel in 1924 from plants in the United States, as reported to the Bureau of Mines, Department of Commerce, amounted to about 156,527,967 short tons, valued at $97,241,641. This was an increase of 12 per cent in quality and 7 per cent in value over the production reported for 1923. Seven states shipped more than 10,000,000 tons each—New York, Indiana, Illinois, Michigan, Pennsylvania, California and Ohio. New York shipped 13,397,540 tons and Ohio, 10,379,361 tons. Pennsylvania led in value of output, its shipments being valued at $10,927,752. New York, Ohio, Illinois, California, Michigan and Indiana followed in the order named, the output of Indiana being valued at $5,070,339. Many other states showed increases. The average value per short ton was 62 cents, as compared with 65 cents in 1923.

Freight Car Loadings

Loading of revenue freight for this season of the year continues to be well in excess of any corresponding period on record, according to reports filed by the carriers with the car service division of the American Railway Association.

The total for the week of September 26 was 1,120,645 cars, the second highest week's loadings this year, being only 3,791 cars behind the week of August 29, this year, which marked the peak loading so far this year and also the high record for all time. This makes the tenth consecutive week that freight loadings have exceeded the million car mark.

Compared with the previous week this year, the total for the week of September 26 was an increase of 22,217 cars, increases being reported in the total loading of all commodities except ore. It also was an increase of 32,691 cars over the corresponding week in 1924 and 23,152 cars over the same period in 1923, and exceeds by a wide margin the corresponding weeks in 1920, 1921 and 1922.

Miscellaneous freight loadings totaled 440,189 cars, an increase of 11,722 cars over the week before and 35,194 cars over the same week last year. It also was an increase of 46,554 cars over the same week two years ago.

Loading of merchandise and less than carload lot freight amounted to 270,343 cars, an increase of 1,485 cars over the week before and 11,875 cars over the same week last year. Compared with the corresponding week two years ago, it also was an increase of 17,123 cars.

Coal loading 178,463 cars, an increase of 6,862 cars over the week before but 15,737 cars under the same week last year. Compared with the same week in 1923, it also was a decrease of 22,492 cars.

Grain and grain products loadings amounted to 55,199 cars, 1,158 cars above the week before, but 14,111 cars under the same week last year. It was, however, an increase of 4,314 cars above the same week in 1923. In the western districts alone, grain and grain products loadings totaled 37,708 cars, a decrease of 13,419 cars under the corresponding week last year.

A comparison by weeks follows:

	1925	1924	1923
Sept. 26	1,120,645	1,087,954	1,097,493
Sept. 19	1,098,428	1,076,847	1,060,811
Sept. 12	975,434	1,061,781	1,060,563
Sept. 5	1,102,946	.....	.....
Aug. 29	1,124,436	1,020,809	1,092,150
Aug. 22	1,080,107	982,700	1,069,915
Aug. 15	1,064,793	1,019,077	1,062,993
Aug. 8	1,051,611	941,407	978,750
Aug. 1	1,043,063	945,613	1,033,466
July 25	1,029,603	926,309	1,041,415
July 18	1,010,970	990,230	1,001,350
July 11	982,809	909,973	1,019,800
July 4	864,452	757,904	850,082
June 27	901,341	908,251	1,021,471
June 20	982,600	803,546	1,005,432
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	984,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
July 11	982,809	909,973	1,010,800
April 4	922,375	961,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
Feb. 28	862,910	944,544	916,624
Feb. 21	925,295	945,679	830,187
Feb. 14	902,877	935,589	816,646
Feb. 7	928,244	906,017	849,352
Jan. 31	896,055	929,623	865,314
Jan. 24	924,254	894,481	896,464
Jan. 17	932,150	894,851	864,297
Jan. 10	932,807	872,023	873,908
Jan. 3	765,727	706,292	727,246

Safety in the Use of High Explosives

By Lieut. Col. Geo. R. Spalding, U. S. Corps of Engineers

IN the memory of all of us there was a time when this paper might more appropriately have been entitled, "Dangers in the Use of High Explosives." That we can speak today of safety in the use of high explosives is a great tribute to the intelligence of modern industrial management.

Without compulsion of law but in close voluntary co-operation with government and with the using industries our great powder manufacturing companies have labored unceasingly and with success to produce dependable explosives—reasonably safe to store, transport and use. Not content with this, they have built up a corps of instructors and a reliable library of well written, fully illustrated pamphlets to teach us how to use and handle them.

In 1906 without compulsion of law the American Railway Association organized the "Bureau for the Safe Transportation of Explosives," borrowed an officer of great ability, Colonel B. W. Dunn, from the Ordnance Department of the Army to head the bureau, and when, as a result, a comprehensive set of regulations was drawn up to govern the packing, marking, loading and transporting of explosives, seventy-eight American and Canadian Railways, operating over 130,000 miles of track, at once adopted and enforced them.

The Federal Law and the regulations of the Interstate Commerce Commission came later—which now govern all railroads and all shippers. But the law, different from most reform laws, came naturally and as a result of pioneering by industry. It is, therefore, accepted by all and enforced by all. Indeed the railway companies and powder companies are the law enforcement agencies in fact if not in name.

And now we find the great users of explosives, mining, quarrying, cement and construction companies joined together and with the manufacturing companies, as members of the National Safety Council, to interchange experiences with a view to insuring a greater degree of safety in the use and handling of explosives on the job. Such a story of intelligent and continued interest in safety measures on the part of industrial organizations is strong evidence that the welfare of the public and of the workers is safe in the hands of modern industrial management.

The management is not altruistic, but is intelligent and knows that no industry can grow into greatness or long endure which unduly threatens the safety of the public or neglects the welfare of its own workers. Fully realizing this, the highest officials of the explosive industry are the vital, moving spirits behind all our safety measures. They know that the success of their industry depends upon our knowing how to use their products safely and yet economically. Just as truly no operation in which the handling or use of explosives plays an important part can be successful unless the management thereof sees to it that the public and the workers are safeguarded.

The interests of the users of explosives are identical with the interests of the manufacturers. In all our problems, therefore, we will find the great leaders of the explosive manufacturing industry and their experts our best advisers and friends.

I am not an expert in high explosives. It has been my great privilege, however, to be charged with the management of some rather large affairs, both in peace and in war, in which the use of high explosives played an important part. The one outstanding lesson which this experience has taught me is that the man who is the managing head, the man who is responsible for the success of an operation involving the use of high explosives must be held personally responsible for the adoption of and enforcement of suitable safety measures. The attitude of the Big Boss must be a correct one, and the superintendents, overseers and foremen serving under him must know that their Chief is as interested in safety as he is in production and in economy, and that he will hold them accountable for safety just as he holds them accountable for production and economy.

In other words, the plan for safety on a job which involves the use of high explosives is not a thing apart to be considered only as it does not interfere with other things. It is a vital part of the plan of operations.

With the risk of appearing somewhat didactic, it is believed that to insure safety a manager must:

First—Study the layout of the entire operation; the conditions surrounding the blasting field, the proper co-ordination of blasting with other operations; and prepare a plan for the entire explosive operation as far ahead as may be possible.

Second—Adopt the policy of using such explosives and accessories as after thorough investigation and expert advice are found to be the most suitable and most dependable for the work, regardless of first cost.

Third—See to it that all men are thoroughly instructed in their duties and in the rules and cautions for safety, and that all materials and accessories are in first class condition. Do not neglect tests and in large operations have them made under expert supervision.

Fourth—By rigid discipline require that the work be executed as planned and in accordance with rules and cautions for safety.

Secondary blasting is a very frequent source of injury from missiles, due to the fact that less attention is ordinarily paid at such shots, but more because they throw further than the larger, better decked shots. A source of injury on construction work, which is frequently overlooked and which must cause trouble in all quarry work is that of falling rock from overhangs. Both overhangs and large plums which require secondary blasting can be eliminated by a careful study of the spacing and loading of holes.

In the past, in most construction jobs and quarry jobs, the location of holes and the amount and character of loading was left to practical rockmen or quarrymen who from long experience in a particular locality, seemed to be able to judge almost at a glance the proper amount of explosive to use and the proper way to space the charges to secure desired results with safety.

They seemed to be able to tell at a glance, but as a matter of fact it was their local experience and the methodical, careful records (mental records only, in many cases) which they kept of past shots and past results, which enabled them to do well what other men would do badly.

Modern quarry work, and modern construction excavation cannot depend upon such men. There are too few of them. Indeed in many localities where new quarries are opened, there are none at all to be found.

Our military experience—particularly our experience in mining operations against the enemy—has taught us that large blasts must be carried out in accordance with carefully preconsidered plans—just as is done in any other large engineering project. In such plans, the location and size of all charges are determined by calculations which are every bit as reliable as those used in the design of foundations for engineering structures. Indeed, because of the more frequent opportunity to test calculations by results, they become more reliable as the work proceeds.

More and more are similar scientific methods being used in our large quarry and construction operations. The computations are not difficult and the data upon which they may be based are available to us all in the form of tables furnished by the explosive manufacturers. The data in these tables are, of course, for average conditions, and particularly is this true in the amount and character of explosive required per cubic yard of rock, and so judgment must be used at first. But, if, as the work proceeds, surveys are made before and after each blast, it will not be long before recorded experience will enable one to determine loading and spacing with a great degree of accuracy.

To make a survey and sketch of the crest and toe of the quarry face, to locate thereon the line of holes, to drop a few plumb lines down from which to determine the thickness of rock between face and line of holes to keep careful record of the loading of each hole and then after the blast to record results at the crest, and after excavation to record results in the face and at the toe, and to keep a special record of the line of flying missiles, seems like a formidable and unnecessary task before it is undertaken, but such methods will reduce secondary blasting, eliminate overhangs, cause fewer injuries from missiles and also, I am convinced, pay handsome dividends on the cost.

There has been a tendency in the past and, to a degree it still exists, to look upon blasting as a dangerous occupation in which occasional injuries and fatalities are inevitable, and but part of the "risk of duty" which men who are men must take, and are proud to take. With such an attitude

I have no quarrel. Civilization advances only because there are men, always have been and always will be men, who think more of duty than of life. But neither in war nor in peace should such men be called upon to risk limb or life unnecessarily. For almost every condition to be met in the blasting field today there are explosives and accessories which will permit the work to be done with reasonable safety. And it is incumbent upon management to see that only those most suitable and safest are purchased, that they are kept in safe and usable condition at all times, and made available to the men as needed.

I think that, by and large, your experience will agree with mine that the most frequent cause of accidents on the blasting field is due to misfires. Misfires come from a variety of causes. In electric firing the most frequent appear to occur when the shots are wired up in series as is necessary when a number of holes are to be fired by a blasting machine.

At Muscle Shoals a blasting foreman reported that since beginning use of a new supply of detonators, he was having too many misfires. He was satisfied in his own mind that the detonators were defective and recommended that the entire lot be discarded and a new lot purchased from the manufacturer who theretofore had been supplying satisfactory caps. To settle the "morale" situation this was done but in justice to the manufacturers of the discarded detonators, they were asked to send an expert to look into the matter. After a careful investigation, it was found that while the resistance of the discarded detonators departed somewhat more from the normal than those which had been used before, all were within reasonable limits, and that the real trouble lay in the fact that the blasting machine, due to wear or improper care, had failed in power. The substitution of a new and stronger machine helped but did not overcome the difficulty.

A similar experience was met with in the construction of Lock Number 1 on the Monongahela River where the use of a stronger machine, and detonators of greater power (No. 8 in place of No. 6) corrected the trouble. After similar trouble with electric blasting machines on the power house excavation at Muscle Shoals, it was decided to resort to firing from the power circuit, connecting charges in parallel.

At Panama, a "number of accidents resulted from steam shovels coming in contact with unexploded charges, which led to an investigation of the fuses and the results obtained from various methods of firing. Previous to that time charges were exploded by a blasting machine, and investigation showed that failures were liable to result when this type of machine was used. Experiments were then made by using the current from the lighting plants distributed along the east side of Culebra Cut, and it developed that while misfires occurred where the fuses were connected in series, there were no misfires when connected in multiple arc. As a consequence electric conduits were laid from the various power plants into the Cut, distributed lengthwise through it within easy reach of the areas remaining to be excavated, and thereafter all holes were exploded by means of current from the dynamos."

There is an inherent difficulty with series firing which cannot be overcome in the present state of the art of cap manufacture. In spite of honest effort by the manufacturers, the resistance of caps to the electric current varies and when a number are connected in series, those in which the resistance is the greatest, heat up and fire first, breaking the circuit so that the others cannot fire.

Special care in making connections, the testing of all caps and of machines and circuits before firing and the use of stronger blasting machines will serve to reduce misfires but even with good conditions, the inherent difficulty mentioned is not overcome. Where a large number of holes must be fired simultaneously, they should be connected in parallel and fired by current from a lighting or power line. For this purpose direct current is preferable but an alternating current of sixty cycle frequency is satisfactory.

Of course even in parallel connection, misfires may occur from defective caps or bad connections, and tests of caps and of circuits must not be omitted.

To reduce misfires still further Cordeau-Bickford may be resorted to. This type fuse has long been known and used in the military service. As you know, this fuse is a lead tube of about one-quarter inch diameter, filled with T.N.T. It is safe to handle, safe to ship and safe to keep, and yet it detonates with such great rapidity as to be practically instantaneous for reasonable lengths.

In military demolitions it is often necessary to drill and load a bridge or other structure with explosive and then await the proper tactical conditions. Nothing is of value in such work which may be injured by delay. By the use of Cordeau-Bickford a number of charges of compressed T.N.T. or other stable explosive may be connected up and kept under guard in readiness for firing. When the time comes for firing, all that is necessary is to attach an electric cap to each end of the Cordeau and fire with a blasting machine.

This fuse is now being used to a very considerable extent in the quarries of our large cement companies. I am confident that before long it will be used in all quarries where well drilled holes are used. In loading the well drill holes, the end of the Cordeau is tied to a cartridge; this is placed in the hole, and the Cordeau is run off the spool until the cartridge touches bottom. After the hole is fully loaded, the Cordeau is cut off a little above the collar of the hole. When all holes have been loaded, they may be connected by a trunk line of Cordeau with an electric cap at each end or an electric cap may be connected with the Cordeau extending from each hole and the various caps connected by wire and fired in the usual manner.

The use of Cordeau by keeping the electric circuit above ground in the dry where bad connections and short circuits can be avoided or easily found by tests and corrected, practically eliminates all chance for misfires. In addition, it eliminates the necessity for making up primer cartridges, a proceeding always attended with risk, and allows the first cartridge to be lowered, not dropped, into the hole.

All in all, it is the safest means known for detonating the charge in well drill holes. I am led to believe, also, that in spite of its rather high cost, it is a cheaper material than caps because it permits the use of a higher cartridge count explosive. As to this, I do not know, but I do know that it is safer and therefore more economical when the job as a whole is considered.

With a good layout plan, a good blasting plan, a proper co-ordination between explosive operations and other activities in the vicinity; with good materials and the most suitable equipment, there should be few accidents in the use of high explosives, provided the men engaged in such operations are suited to the work, are properly instructed in their duties and responsibilities and imbued with a proper sense of safety discipline. Regardless of other qualifications, there are some men who can not be trusted to handle or use high explosives with safety. Natural awkwardness, timidity and absentmindedness are characteristics as much to be feared as bad habits and recklessness. The personal characteristics of men can only occasionally be discovered before trial.

Safety, therefore, demands that all operations must be as nearly fool proof as it is possible to make them, and because it is impossible to make them absolutely fool proof it is necessary that the men engaged, and all explosive operations all the way from receipt of materials, through care and transportation to final use, be under the supervision of a competent and careful head, who, if he be not an expert in explosives and electricity, must have ready access to the advice of such experts. Such a man, supervisor of explosives, if you wish to call him that, will co-ordinate the selection of the men, their training and their discipline in a manner to insure that proper methods are used and proper precautions taken. But he will also keep abreast of the developments in explosives and explosive accessories and in touch with the history of accidents and their causes with a view to eliminating similar causes from his own work. He will not be satisfied with a mere printed list of rules and cautions but will investigate the reasons which brought about their adoption and be prepared to develop and issue new instructions which carry the weight of his own authority.

The premature explosion which occurred at Bas Obispo, Panama Canal, in December, 1908, which resulted in the death of 23 men and the injury of 40 others is an example of an explosion which leads to the development of new and living rules.

"Fifty-three holes had been drilled and sprung. Too prompt loading after springing had caused an earlier premature explosion, due to the heat in the holes and therefore 48 hours was allowed to pass before loading was begun.

"A total charge of 44,000 pounds of 45 per cent dynamite was then load-

(Continued on page 108)

How A Canadian Cement Plant Operated For One Year Without An Accident

By L. M. McDonald, Superintendent for Canada Cement Company*

ACCIDENT prevention as applied to industries has advanced so rapidly during the past few years, that it is essentially an asset or a liability on the balance sheet of any company, and in the eyes of the employee it is virtually a determining factor in his choice of occupation.

It is, without a doubt, a non controversial subject and solicits wholeheartedly the closest co-operation between employer and employee. Executives have proven by their manifold interest and concentrated support, that they are behind this great movement; and the ultimate success of any undertaking which has the endorsement of the management of any company, must of necessity, depend on the subordinates of the company, on whom has been conferred the authority to govern, according to the ideals and principles of the company. Conferring authority and responsibility upon capable men is the wisest and most far reaching policy that can be adopted. Such selected men, entrusted with power, are sure to develop qualities which are invaluable to any organization. They naturally respond to the confidences placed in them and serve the company with earnestness and devotion. The latent capacity for initiative, ingenuity and accomplishment must have some opportunity to develop and expand, and in what better form can these inherent qualities of mankind be better directed than in accident prevention work, which is a service to his fellow man and loyalty to the ideals and standards established by his company.

Inspired by the above principles and encouraged by their application, we at plant Number 8 of the Canada Cement Company will attempt in our humble way to deal with the question of accident prevention as applied to our plant and the reasons for our success in operating the plant for 340 days without an accident, as the title of this paper indicates. Our experience and efforts were expended with various safety organizations, until we adopted the present permanent safety organization, namely, that the foreman to whom we look for efficiency and production, we also hold directly responsible for the general maintenance of his department; including cleanliness, guards, safe conduct and practice of all employees under his direct control and supervision.

To treat this subject intelligently, a brief resume of our work since we first became vitally interested in safety work is necessary. I realize that statistics are very uninteresting and for that reason reference will be made only to those covering yearly operations and the various safety organizations in effect during the respective periods.

During the year 1920, accident prevention work at our plant did not receive any special consideration; we had no active safety organization and accidents apparently had to happen. At least, it was readily granted by all concerned that it was impossible to prevent them. Our record for the year showed 44 accidents, including fatalities and 924 days of lost time.

The early months of 1921 threatened to place us in the category of a hazardous plant and occupation. With a toll of 41 accidents for the first five months, our Head Office entered the scene and politely informed us that we must take measures to cope with the alarming situation and institute some form of safety organization to reduce the number of accidents. We decided to make June a No Accident Month. Committees were formed in all departments, and ways and means were discussed to counteract the deplorable record we had established and the low state of morale which existed throughout our plant. Naturally, everything must have a beginning, and although we failed utterly to reach the goal of a No Accident Month, our committees continued to function every week during the year. We closed with a standing of 67 accidents and 948 days lost time.

Some change in our system was evidently necessary, so we disbanded the departmental committees and formed one general committee, com-

*Paper presented on September 29, 1925, before the Cement Section of the National Safety Congress held in Cleveland.

posed of the foreman and three representatives from each department. We concluded that it was necessary to teach safety, so the subject matter of our meetings dealt entirely with the question of education. We can candidly say that this form of treating the subject was our first sincere attempt to grapple with the problem from a logical premise and lay the foundation for our future success. You must creep before you can walk, and with teaching safety by education you must sow the seeds by facts and figures, so that even the skeptics will eventually be converted. Time and patience are big factors in such a program; obstacles will be encountered and setbacks are bound to occur, but the inborn tendencies of mankind are sure to react to certain influences if you persist in the same direction.

Under our new policy we had our first No Accident Month in February, 1922. During that year we successfully bridged four months clear of accidents and ended the year with 13 accidents including 3 fatalities and 323 days of lost time.

In order to acquaint as many employees as possible with our education propaganda we changed the personnel of our general committee every three months, always retaining the departmental foreman as a permanent member. We were pleased with our past success, and here we introduced into our education program a weekly plant paper which has been a medium of information and a messenger of safety in our struggle to combat the evils of carelessness, thoughtlessness and insufficient knowledge and training.

April and June of 1923 were "No Accident Months," but a reaction set in during July, which was indeed discouraging. Undaunted, however, we increased our efforts to combat the tide of misfortunes, which appeared to be undoing our best efforts to establish and sell our safety education. After careful deliberation we decided to reduce our safety committee to include only foremen and thereby confer on the foremen the authority and responsibility for all future accident prevention work. No man can stand still; he must either go backward or forward. We believe that men who are led to take responsibility go forward, because they realize that they are expected to build up their part of the organization, and for that reason more initiative and energy is expended on the work.

With this success a new lease of life and an esprit de corp was developed which convinced us that teaching safety by education through the medium of the foreman was the proper method. At our meetings, which were really round table talks, we discussed operating, mechanical, good housekeeping and general plant conditions. Cleanliness to my mind is the most important factor in a Safety First campaign. Put your plant in first class condition both internally and externally and thereby eliminate from the minds of all employees the idea that careless handling of material is tolerated. Insist that a good-housekeeping policy be adopted and maintained. Who is better qualified to co-operate with this policy than your foremen?

The past year with a clean plant and all foremen real safety first enthusiasts and preachers, we closed with three accidents, including one fatality and 39 days lost time. We successfully campaigned nine No Accident Months and certainly proved that results can be obtained if knowledge, enthusiasm and loyalty are created and fostered.

After three years of steady persistent work in perfecting an organization for our safety work, we decided to aim at a very ambitious goal and attempt a No Accident Year. All the foremen were enthusiastic and expressed confidence that this goal could be reached. We had our last accident on September 25th, 1924, and we have passed successfully 340 days, with the Honor Flag which we raised the first of the year still flying.

Now for a short resume of the main reasons for our success. We have a clean plant, an asset to any successful drive for safety work. We have a weekly paper, a medium of spreading safety information throughout the rank and file of the organization and at all times keeping the important question of accident prevention over to the fore. We have our departmental dials recording the number of days since our last accident and operated in some cases by the employee individually as his turn arrives. We sign all new employees in our First Aid Department and therefore introduce them to all rules and regulations covering the work

and impress on them the necessity of attending to all cuts and bruises, even the most trivial.

We have our executives and foremen sold on the idea that accidents can and must be prevented and that their responsibility for efficiency and production does not cease at this point, but must include cleanliness, maintenance, installation of guards and accident prevention education to all employees under their direct control and fullest co-operation in all matters pertaining to general plant safety.

If a foreman possesses the qualities of leadership, foresight and vision, he will organize his department and turn the work over to men qualified to bring about the perfomance of those duties, men whose success will be judged solely by their accomplishments. You can, no doubt, achieve a degree of success on accident prevention work by any method you adopt, but the sound policy for a permanent organization is to confer the authority on your foreman. Hold him to account for results and you will be surprised to see how rapidly your Safety work becomes a real part of his daily occupation. He will think and act of his own accord and with every thought and action comes the great ambition of every man to safeguard and protect the welfare of his fellowman. When this spirit takes hold, it is indeed contagious. and success in any undertaking will eventually crown your efforts.

The Seaverns Shaking Screen

James B. Seaverns manufactures a sturdy screen for crushed stone and sand and gravel plants where a clean and uniform product is desired. The Seaverns Balanced Shaking Screen is so designed that the horizontal weight of the top deck balances the weight of the lower deck. These two weights traveling in the opposite direction balance themselves, thus overcoming vibration on the supports due to the high speed of the screen.

The shaft, bearings, eccentrics, straps and connecting rods are very substantially proportioned and are made of steel to give long life. The eccentric straps are babbitted with the best grade of engine babbitt. Large compression grease cups are fitted to provide ample lubrication. The connecting rods are of one inch flat steel bars five inches wide, provided with a cast steel pitman with a split bronze bushing to take up wear at the outer end. The eccentric shaft is driven by a 30 inch flywheel pulley 12 inches wide, running 150 revolutions per minute. This balance wheel creates a smooth turning movement and greatly aids the movement of the screens.

The screen frames are of steel channels, plates and angle bars, solidly riveted together forming a rigid frame on which is carried the perforated steel plates and wire cloth sections. Perforated plate is used in the upper deck and steel wire cloth set in individual frames in the lower deck.

At the front end of each deck is mounted a solid steel shaft to which are attached the steel eccentric rods. These shafts extend beyond the sides passing through a cast steel boxing, riveted solid to the sides. This boxing is fitted with a large set screw for securing the shaft.

At each corner of the screen deck is an adjustable angle iron hanger for setting the screen to the proper inclination for best efficiency. The top supporting shaft is supported on the building framework to carry the hangers.

Foote Purchases New Equipment

Foote Bros. Gear and Machine Company have recently purchased equipment for the manufacture of the modern type of herringbone gears without the center groove.

The equipment will be installed and ready for operation by October 15th, after which the company will be in a position to produce "Backbone," Herringbone Gears, in all standard sizes.

They will also produce a complete line of Herringbone Speed Reducers of the heavy-duty type, comprising single, double and triple reduction units up to 125 H. P. capacity and reduction ratios up to 120 to 1.

New Foote Appointment

Foote Bros. Gear and Machine Company of Chicago, manufacturers of IXL Speed Reducers and Gear Products, announce the appointment of Mr. George Roberts as representative for Detroit and environs. Mr. Roberts will make his headquarters at 576 Montclair Street, Detroit.

(Continued from page 104)

ed, the fuses set, and all holes tamped before any connecting wires were strung. This latter precaution was taken because an earlier premature explosion had resulted from a current induced in the connecting wires. As the last hole was being loaded the explosion occurred.

"It was a clear day, there was no lightning, and the dynamos from which firing current was to be had were not even running. While the cause of the accident was never positively ascertained, it developed later, when the water in the bottom of the holes was chemically examined, that it was sufficiently acid to attack the dynamite cartridge and liberate the nitro-glycerin.

"A secondary blast had been fired just across the Cut from where the explosion occurred and it was assumed that the free nitro-glycerin in some of the holes detonated from the jar of this secondary blast and as all the remaining dynamite charges were connected with caps, the detonation of the entire lot followed.

"As a consequence, instructions were issued that no loading operations would be undertaken in any area that could not be completed and fired the same day."

Personal experience is a harsh schoolmaster. It is pleasanter and cheaper to learn from the experience of the past than from our own disasters. I find there is much literature on the use of high explosives; some of it of great value. A real living write-up of disasters and mistakes in quarries and on construction jobs would carry the lessons of the past home to us as no other method except personal disaster or mistakes can do.

New Tractor Catalog

The Mead Morrison Manufacturing Company have now ready for distribution catalog number 26 which concerns the Mead Morrison "55" Tractor.

The new catalog contains an interesting discussion of the origin and development of the crawler type tractor. Each unit of the Mead Morrison tractor is described and illustrated. The various applications of the machine are also discussed and some illustrations showing the machine operating on actual projects accompany the text.

New Koehring Catalog

Koehring Company has issued a new catalog dealing with the number one shovel crane and dragline specifications. The catalog contains detailed data on the construction and applications of the number one Koehring heavy duty gasoline or electric shovel.

The working and general dimensions of the machine are presented in tabular form. Various details are illustrated and described such as the dipper, dipper bail block, the boom

and shock absorbing boom, the shipper shaft, the crowding and racking in mechanism, the crane, the treads, traction drive, turntable gear, steering mechanism, clutches, power plant, drums, etc. In fact, every unit is discussed in all its applications.

A very useful crane load and crane radius diagrams are included in the catalog. All operators desiring any information on the Koehring number one shovel crane dragline will find it in this catalog. Others will find the catalog a valuable addition to a library. The Koehring machine is well known in the non-metallic mineral industries, but it will be thoroughly understood after a study of this catalog.

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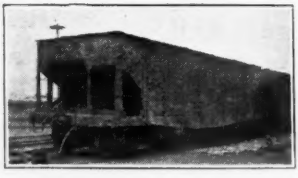

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JAW CRUSHERS

One 4"x10"; One 5"x10"; Two 8"x14"; Six 9"x15"; One 10"x26"; One 12"x24"; Two 13"x30"; Two 16"x30"; One 19"x 36"; One 24"x36".

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1—No. 4 Keystone Excavator No. 4296, with skimmer scoop and trench bucket.

HOISTS (Steam)

1—7x10 single drum Skeleton Lidgerwood.
1—8½x10 three drum and boiler Lambert.
1—10x12 D. D. and Swinger Skeleton Lidgerwood.

HOISTS (Electric)

1—22 H.P. two drum Flory with 2Ph. 60C. 220V. Motor and Solenoid brake.
30—Separate Clyde Electric Swingers with 10 H.P. 3Ph. 60C. 220V. Motors, or without Motors.

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1—10 ton 80' boom 14"x14" Terry Timber Stiff Leg with 12' Bullwheel.
1—20 ton 70' boom Steel Guy (Erector's type).

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2—½-yd. Handler Type Lakewoods.
1—¾-yd. Handler Type Lakewood.
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1—1½-yd. Class E Hayward.
1—¾-yd. Page Dragline.
1—1¼-yd. Page Dragline.

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1—12-in. Centrifugal Pump Dredge.
1—1½-yd. Marion Dredge.
1—2½-yd. Marion Dredge.
1—4-yd. Marion Dredge.

CRUSHERS

1—36 in. x 48 in. Traylor, Jaw.
1—No. 9 Gates, style "K," manganese fitted.
1—No. 8 Gates, style "K," chilled iron fitted.
1—No. 7½ Austin gyratory, chilled iron fitted.
3—Symons Disc, 48 in., 24 in. and 18 in.
1—Austin No. 5 gyratory. 1—Gates No. 4.
1—Allis Chalmers No. 3, suspended head.

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1—Marion Model 37 Electric.
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1—Bucyrus 18-B, 1 yd. traction.
1—Marion Model 28, two booms.

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1—22 ton O. & S. with a 50 ft. boom.
1—Northwest Model 105, comb. crane & dragline.
1—O. & S. 7 ton, steam rail crane, 30 ft. boom.
1—O. & S. 7 ton, gas. caterpillar used 4 mons.

BOLL MACHINERY COMPANY, Not Inc.
140 S. Dearborn St., Chicago, Ill.

CRANES

1—TYPE B ERIE, full revolving Steam Crawler Crane, Shop No. 2600 new late 1923, ALL STEEL CATERPILLARS, A. S. M. E. boiler; 40-ft. crane boom, bucket operating; like new.

1—20-ton, 8-wheel, OHIO, Type "CD" Locomotive Crane, Shop No. 3631, new 1924, A. S. M. E. and Mass. boiler; 50-ft. boom; double drums, M. C. B. trucks used four months, guaranteed perfect condition.

DUMP CARS

36—4-yd., 36-in. gauge, WESTERN, two-way side Dump, new 1923, Heavy Duty, 4-pedestal, STEEL DRAFT BEAMS, Box Girder, Doors, overhauled, first-class condition.

Grey Steel Products Company
111 Broadway — **New York, N. Y.**

Quarry Equipment For Sale

at St. Genevieve, 65 miles southwest of St. Louis.
Complete Plant—Buildings—Power House—Office—Blacksmith Shop—Tool House—Hoist and Swinger House.

Machinery and Equipment.

2—150 H.P.—72" dia. x 18 ft. long Return Tubular Horizontal Boilers—30" stacks—50' long.
1—6x4x6 Gardner Duplex Feed Pump.
1—W. B. 2—1200 ft. Sullivan Compressor.
1—36" dia. x 11' long Receiver.
1—50 Ton Steel Derrick 80' Mast 76' Boom 1¼" guy lines
1—Hoist—DD—DC.
1—Swinging Engine
8—Sullivan Air Drills
3—10' Quarry bars complete with saddles and cradles.
1—8' Quarry bars complete with saddles and cradles.
5—Broching Hammers
1—Trimming Hammers
1—Tripod
Complete equipment of tools, air lines and hoses.

Consolidated Marble Corporation
30 North LaSalle Street, Chicago, Ill.

CABLEWAY

800 ft. span cable way complete with Lambert engine.

HOISTS

5½"x8" American D.C. D.F.D. with boiler.
7"x10" D.C. D.F.D. with boiler.
8¼"x10" Lidgerwood D.C. D.F.D. with boiler.
7¼"x10" Mundy with boiler (New).
8¼"x10" Mundy with boiler (New).

AIR COMPRESSORS

550 cu. ft. Ingersoll-Rand belted.
350 cu. ft. Ingersoll-Rand steam-driven.
8"x8" belted.

MAGNETIC SEPARATOR PULLEY

24"x26" Cutler-Hammer direct current 110 volts.

CLAMSHELL BUCKETS

2—2½ yard Browning.

WM. C. JOHNSON & SONS MACHINERY CO.
1211 N. 12th St. St. Louis, Mo.

SURPLUS EQUIPMENT

(Buy it right off the job and get it cheap.)

BOATS	DRAGLINES	PIPE
BOILERS	DREDGES	SCALES
BATCH BOXES	DRILLS	ROLLERS
BELTING	ENGINES	SCRAPERS
CABLEWAYS	FORMS	SHOVELS
CARS	FINISHERS	TRACTORS
COMPRESSORS	GRADERS	TRUCKS
CONVEYORS	HOISTS	TRACK
CRANES	LOADERS	TANKS
CRUSHERS	LOCOMOTIVES	WAGONS
DERRICKS	MIXERS	PAVERS
DITCHERS	MOTORS	PUMPS

I have equipment located in practically every state in the Union.

ALEXANDER T. McLEOD
First Nat'l Bank Bldg., Chicago

3—3½ yd. SHOVELS

Railway Type, Mang. Dippers
Crushers #10, 9, 8, 7½, 6, 5, 4, 3,
Roll Crushers
84x72, 36x60, 54x24, 18x30
Jaw Crushers
22x52", 36x42", 42x48", 20x24", 15x36"
DISC CRUSHERS, 43", 36", 24", 18"
OIL ENGINES
50-75-100-200-500-650 H.P.
Kilns, Pulverizers, Air Comps.
2—200 H.P. MOTORS S RING
440 v., 60 cy., 3 ph., 435 rev., G. E.

Ross Power Equipment Co.

13 South Meridian St., Indianapolis, Ind.

Hyman-Michaels Co. Offers Another HOIST Bargain

Exceptional Purchase Places Nationally-Known Lidgerwood and American Hoists on the Market

Less than one-quarter the regular price—that is our offer on these hoists. We bought them at a big reduction from their real value, and to dispose of them quickly we will sell them at

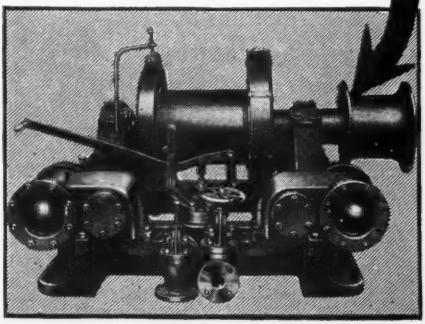
$195 Each, While They Last

Both the 7x12 Lidgerwood and 8¼x8 American Hoists offered here are of the Two-Cylinder, Single-Drum type, with reverse throttle, single geared; hoisting capacity 5,000 and 10,000 lbs. For hoisting and pulling in mines, construction work, etc.; for use on ships, tugs, barges; for skidding, swinging, car pulling, etc., these hoists are in constant demand. Our special bargain price while they last is only *$195.00 each, f. o. b. nearest shipping point.* These hoists will be loaded from Chicago or St. Louis.

We also own and offer complete stocks of New and Relaying Rails, First-Class Locomotives, Ballast Cars, and a full line of Flat, Box, Refrigerator and Steel Hopper Bottom Cars and Cabooses in excellent condition and at attractive prices.

Hyman-Michaels Co.

Peoples Gas Building, Chicago, Ill.
Railway Exchange Bldg., St. Louis, Mo.



1—I-R Compressor—1190 ft.—Belt Dr.
4—36 in. Gage Electric Locomotives.
1—Byers "BEAR CAT" Crane.
1—Thew Shovel ¾ yd. Cat. Tr.
2—4 Drum McMyler Shaft Hoists.
1—7E Dake Hoist, 30 H.P.
5—12 yd. Std. Gage Dump Cars.
5—4 yd., 36 in., Gage Dump Cars.
1—10 Ton Buffalo—Springfield Roller.
1—3½ Ton Tandem Roller.
18 in. and 24 in. Conveyor Belt and Idlers.
2—28-S Ransome Concrete Mixers.
1—Tank Wagon.
12 in. and 14 in. Centrifugal Pumps.
1—Marion 21 Shovel ¾ yd. Cat. Tr.
Derricks, 2 and 3 Drum Hoists.

J. T. WALSH
500 Brisbane Bldg., Buffalo, N. Y.

For Sale

3—four yard Western Dump Cars, practically new.

1—10x16, 36 inch gauge Davenport Locomotive.

1—6x10, 36 inch gauge geared Davenport Locomotive.

1—four wheel, 10 ton locomotive Crane.

Above equipment thoroughly overhauled.

Glenn Locomotive Works
COVINGTON, KY.

AIR COMPRESSORS

92 ft. Ingersoll-Rand, ER-1, Belted
355 ft. Ingersoll-Rand, ER-1, Belted
355 ft. Ingersoll-Rand, FR-1, Steam
528 ft. Ingersoll-Rand, ER-1, Belt
599 ft. Ingersoll-Rand, Imperial XB-2, Belted
888 ft. Ingersoll-Rand, Imperial XB-2, Belted
1190 ft. Ingersoll-Rand, Imperial XB-2, Belted
1145 ft. Chicago Pneumatic, OCB, Belt
1400 ft. Chicago Pneumatic, OCB, Belt
1500 ft. Ingersoll-Rand, Imperial XB-2, Belt
1270 ft. Chicago, OCE Motor Driven, 3 phase, 25 cycle, 440 volt
1308 ft. Chicago, OCE Motor Driven, 3 phase, 60 cycle, 2200 volt
6—212 ft. Chicago Portable Oil Engine Driven Compressors
Portable Gasoline Driven Compressors.

PITTSBURGH PNEUMATIC MACHINERY CO.
507 Liberty Ave., Pittsburgh, Penna.

Steam Shovel Bargain

1 Model 28 Marion Caterpillar Steam Shovel; Shop No. 4401. 5/8-yd. Dipper; Boom Hoist; Westinghouse Air Compressor mounted on cab for operating rock drills, etc. Heavy steel cab. Our shovel work recently finished.

Bellaire Land & Dev. Co.
Bellaire, Ohio

RAILS

All sections, new and second hand. Centrally located. Also Cars of all kinds. Immediate shipment guaranteed.

M. K. Frank
Union Trust Bldg., Pittsburgh, Pa.
Park Row Bldg., New York City

RAILS New and Relay

ALL WEIGHTS AND SECTIONS
FROGS—SWITCHES—TIE PLATES

S. W. LINDHEIMER
38 S. Dearborn St. Chicago, Ill.

LOCOMOTIVE

10x16, 36", 15 ton, Baldwin saddle tank, special bargain, sell or rent, 100 carloads, gravel plant, contractors' and miscellaneous machinery in stock.

HACKLEY MORRISON COMPANY, Inc.
1708-1722 Lewis St., Richmond, Va.

FOR SALE

1—150 Bucyrus Steam Shovel, 2½ yd. dipper.
1—175 Bucyrus Steam Shovel, 3½ yd. dipper.
1—35B Bucyrus Steam Shovel, 1½ yd. dipper.
1—No. 6 Keystone Excavator with Skimmer scoop.
1—7½ ton and 1—14 ton steam Locomotives.
2—150 H.P. high pressure Boilers.

The Pittsburg Boiler and Machine Company
PITTSBURG, KANS.

HEAVY CRUSHING ROLLS
We Own and Offer for Sale

One set of Sturtevant 36"x16" Balanced Type CRUSHING ROLLS in good condition with spare parts. Located Northern New York State.

HOOPER-MOMBERGER CO.
Room 1703, 90 West St., New York, N. Y.
Phone Rector 2919

FOR SALE

10 Ingersoll-Rand X-70
Rock Drills
50% of new price.

ARCHER ARMSTRONG, INC.
Grand Central Terminal Bldg.
New York City

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